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A Weekly Journal Devoted to Industrial and Engineering Chemistry

VOL. LIV
No. 1397

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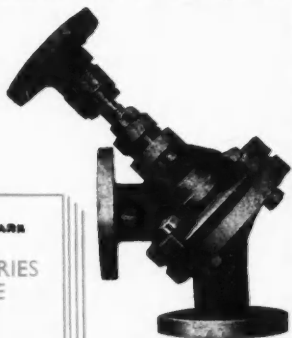
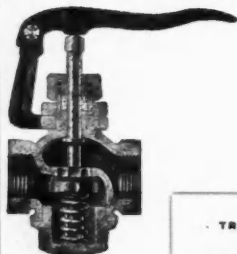
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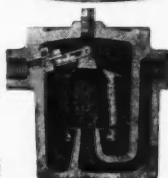
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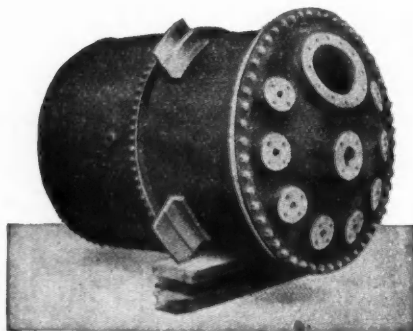
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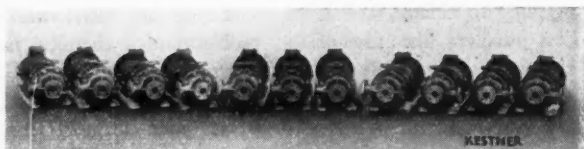
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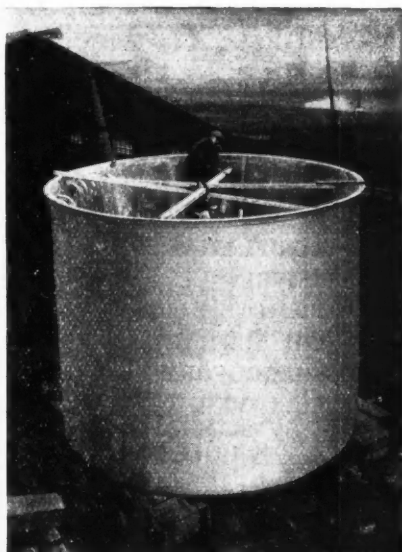
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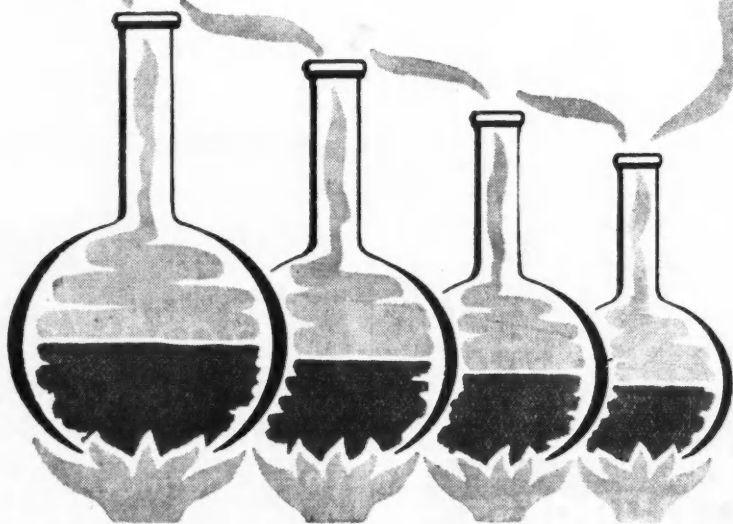
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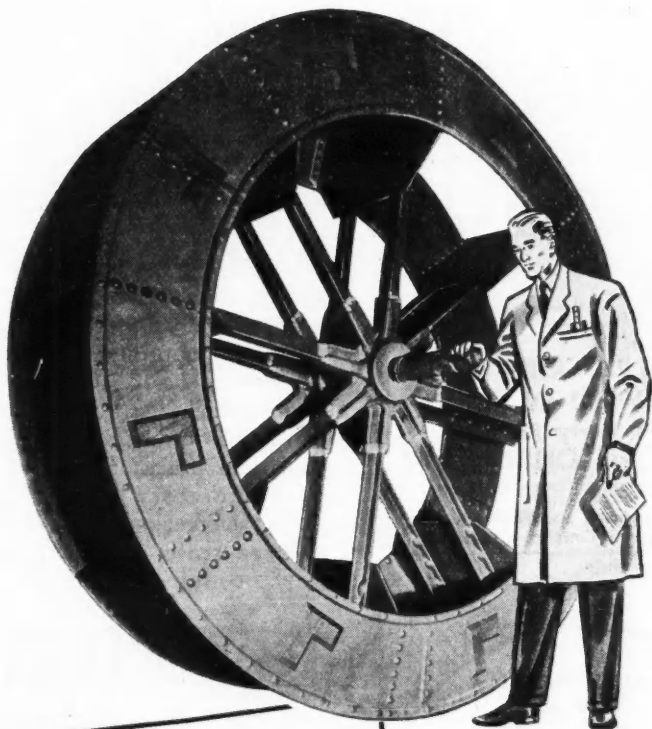
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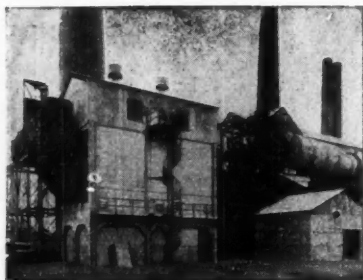
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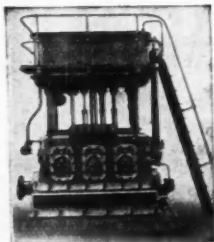
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What We Owe to Chemical Science

IT is probable that, apart from the chemists, very few people indeed realise how much the world owes to chemistry and to those who practise it. There are two ways of looking at the chemist. One view, which is all too often heard, is that the chemist is a rather unpractical individual who shuts himself up in his laboratory and except as a help in time of trouble is not regarded as being of much consequence in the world of affairs. This view has been argued in these columns at considerable length and we do not propose to do more than mention it here before turning to the other side of the medal. That is a picture of the chemist who, whether working alone or in communication with his fellows, has made contributions to the well-being of mankind of such outstanding importance that it is difficult to see why the reverse view should ever be expressed.

The Royal Institute of Chemistry issued in 1918 a book under the title *What Industry Owe to Chemical Science*. This book appeared at a time when the importance of the chemist had been forcibly brought to the attention of the world through the events of 1914-18. A second edition of that book was published in 1923 and now a third edition,* which has

been substantially re-written by over 50 contributors, has been issued. The proceeds from the sale of this publication are to be given to the Benevolent Fund of the Royal Institute of Chemistry.

The late Sir George Beilby, in a foreword to the original edition, stated "The place of chemistry in our national life has been far more important than the majority of educated people have imagined, and this place bids fair to become of vastly increased importance in the near future. . . . Trained chemists will be in increased demand for industrial and official positions." Professor Lindlay, in an introduction to the present volume, has pointed out that the "number of trained and competent British chemists is now several times greater than in 1914.

In the intervening period, the percentage of chemists unemployed has rarely exceeded 2 per cent. and has been far less than that of other professions."

The development of fertilisers has been one of the triumphs of chemistry, for without that development the world could not have supported its present population. But the use of fertilisers on so large a scale carries with it grave implications and responsibilities, as we can see from the present world food shortage. If for

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* Heffer, Cambridge, pp. 372
18s

any reason the fertiliser supply failed, huge numbers of men, women, and children would perish, since our world population is largely built on the increased production of foodstuffs rendered possible by fertilisers. Chemistry has fortunately discovered a means of producing suitable materials from atmospheric nitrogen, and the focal point of maintenance of supplies has been transferred from raw materials to the power necessary for the production of fertilisers.

In the production of fuel and power, the chemist has not been idle. The development of our coal resources has owed much to the chemist and his colleague the physicist. Mining employs the chemist; fuel utilisation is now almost correctly described as a branch of chemical engineering. In the vast field thus opened, science has played an outstanding part—a rôle with an importance that was not recognised by many people until the fuel efficiency drive disclosed how much there was still to be done by the chemical engineer in this field. This country now faces the exhaustion of its fuel reserves within a period not much longer than that of the industrial revolution behind us. What effect will that have on the history of the world and of this country in particular? Failure to maintain coal supplies would be catastrophic. But the physicist and the chemist are coming to the rescue again with the promise of utilisation of interatomic energy. Nor is the contribution of the chemist to food supplies confined to the manufacture of fertilisers. The work of the agricultural chemist in assisting the farmer has been described in these columns: agriculture is fast becoming a branch of applied chemistry.

In the preparation of food, too, the chemist has played a great part, and what was formerly nothing more than a rule-of-thumb domestic art has become an operation in manufacturing chemistry. The baking of bread, for example, is a complicated biological process involving the use of the living yeast organism. The mass production of bread has become necessary with the increase in the population; but without scientific direction bakeries could not function efficiently, and their product might well be unsavoury and unsatisfactory. The dairy, the oils and fats manufacturer, the sugar refiner, the distiller, and the brewer all depend largely on the chemist. The rôle of the chemist

in the food industries has been in part to increase the value of the foodstuffs produced (who can forget the vitamins?) and in part to make the manufacturing processes more efficient, with larger yields of good-quality product so that more people can enjoy "the manifold fruits of the earth." The story of sugar will serve to illustrate this. Sugar was introduced into Europe about the 15th century, but its price was such that for at least 200 years only the well-to-do could afford it. Then came the chemist. Scientific research in the field and in the laboratory caused the price to fall and brought it within the reach of all. In 1700 annual consumption was 4 lb. a head, in 1820 about 18 lb., and in 1938 it reached 90-100 lb. The British beet-sugar industry, a chemical industry essentially, now produces about 25 to 30 per cent. of our present requirements.

Let us turn to another field—cosmetics. Here we are amused—light relief is often welcome—to read that "until quite recent years, woman's desire to protect her skin, to beautify and to embellish it, to change, maybe, the colour of her hair, to decorate her finger- and toe-nails with colour—in short, to heighten her sex-appeal—was generally regarded as a desire unworthy of the serious attention of men of science. It is now recognised that, in achieving the desire, not only is she fulfilling a biological necessity, she is also performing a social service." Next time our girl friend powders her nose and reddens her lips in our presence we shall know exactly what is passing through her mind—or shall we? Jesting apart, there is no doubt that the cosmetic chemist has brightened the world and has added joy to the lives of many, besides doing work that is very necessary—on some occasions—in aiding nature.

If we are thus led up the garden path into believing that beauty is no more than skin deep, what shall we say of the chemist in relation to the soap industry? Cleanliness is proverbially next to godliness, and the chemists who have developed the soap industry have done a great work of far-reaching importance in bringing cleanliness to a world that fairly wallowed in the dirt of the Middle Ages. The change in personal habits over the past two or three centuries has been so great, and has brought with it so much longer an expectation of life, that the soap and laundry chemists may fairly claim to be among the greatest benefactors of man-

kind. Carlyle recognised three great elements of modern civilisation—gunpowder, printing and the Protestant religion. To these we would add a fourth—soap.

So the story may continue till no doubting Thomases remain. The chemists control insect pests, they brighten the lives of mankind with their dyes, they show us how to dye, to bleach, to print fabrics and generally how to adorn ourselves and our houses. They make for us new materials of synthetic fibres until we shall one day say with perfect truth that not even was Solomon arrayed in such magnificence as the humblest citizen of Britain. In paints and varnishes, in photography, and by no means least, in water purification and sewage disposal, the chemist has made, and is making, a magnificent contribution to the amenities of modern life, and to the enjoyment of life through reduction of disease.

The chemist, too, has made great contributions to the production of the chemicals used in many other industries. Sulphuric acid, soda, and all the other substances which come under the title of "heavy chemicals" have long been recognised as peculiarly the chemist's sphere. The utilisation and refining of mineral oils has been another sphere in which the discoveries of the chemist have led to problems in production for chemical engineers. The solution of these has created a vast

industry which plays no insignificant rôle in international politics. In all these industries, and indeed in nearly every major chemical industry, the chemist must first make his experiments. He must lay bare the secrets of nature, he must show what are the underlying principles of the process, and he must lay down the conditions for success. His is the laying of the foundation-stone and after him follow the chemical engineer and all the other classes of engineers who must build the edifice in which the discoveries of the chemist will be put to practical application. The mineral-oil industry is an excellent example of this, whether it be considered as comprising petroleum only or the production of oil and other materials from coal by hydrogenation or the Fischer-Tropsch process. The winning and utilisation of minerals and metals, the production of building materials, of refractories, and of road-making materials, the production of ceramics, of glass, and of vitreous enamels are all examples of major industries in which the chemist has played a dominant part in laying the foundation and is playing a dominant part in production which will enable these industries to prosper and expand. These are a few of the directions in which the work of the chemist has been shown in this book to have benefited mankind to an outstanding degree.

NOTES AND COMMENTS

Man-Power Tug-o'-War

WE have already heard of an occasion on which the members of two Government departments were not on speaking terms, and communicated only through an outside source. This was in war time, when tempers were high. To-day again, however, we see the makings of a pretty interdepartmental quarrel between the Ministry of Supply and the Ministry of Labour over the question of the training of scientists. Replying to questions in the Commons last week, Mr. Wilmot outlined the national plans for the development of interatomic energy, and spoke in the customary manner about "British brains allied to our special engineering ability," the Government's "determination to carry that research and development through with great energy," and said that "expert staff was being recruited." "The Government's policy,"

he continued, "was to encourage and support, in every way, research at the universities and elsewhere on fundamental problems . . . they were prepared to devote as large a sector of the national effort as could be spared to this development," etc., etc. We have heard all this before, or something very like it, and Mr. Wilmot knows as well as anybody else that you cannot carry on research, much less recruit expert staff, without a very considerable amount of preliminary training.

Industry Takes a Hand

NOW let us examine the reverse of the medal. At fairly frequent intervals, leading academic scientists have been writing letters of protest to *The Times*, complaining that the calling-up arrangements of the Ministry of Labour interfered (to say the least of it) with the training of young scientists—the men who,

in the normal course of events, would serve as recruits in Mr. Wilmot's ideal teams of experts, as well as in other functions of prime importance to the well-being of their country. The names of Briscoe, Levy, and Finch, and, most recently, of Southwell, must surely be supposed to carry weight as denominating leaders of the academic side of science. Perhaps they mean just nothing to the panjandrum of the Labour Ministry; or perhaps their protests are brushed aside as nothing more than the peevish outpourings of testy dominies disappointed at the sight of empty classrooms. At all events they have had no *direct* effect so far; but they have succeeded in winning a doughty ally on the industrial side. Mr. C. F. Merriam, chairman of British Xylonite, has joined battle on the side of the professors.

Cross-Purposes

IN his letter, in *The Times* of March 29, he complains that "it is hard to understand the action of the Ministry of Labour in restricting further scientific education and the opportunity for academic research, which is part of that education." Despite the urgent desire expressed by members of the Government that industry should make full use of scientific methods (reinforced by Mr. Morrison at the F.B.I. conference on industry and science), he says, "the Ministry of Labour quietly goes on denying the necessary training to sufficient numbers of students and post-graduates to keep industry supplied." Here are cross-purposes with a vengeance! This competition between two departments of the same Government may cause the confirmed individualist to chuckle, but it surely represents a deplorable waste of effort, and gives an interesting indication of what can happen under State control.

Control of German Industry

ANNOUNCEMENTS in the daily Press give details of the Allied plan for controlling the level of German industry (published on March 28 in Berlin), in accordance with the Potsdam agreement. German industry, it is stated, is to be divided into four categories. Of these, the first, the prohibited industries, are no different from the preliminary list detailed in our issue of March 2 (p. 233); the second group comprises those industries for which levels have been fixed so that

excess production capacity may be removed for reparation purposes; the third category (in which coal and potash are conspicuous) also has fixed levels for 1949, though it is not at present intended to exact reparations from this group; in the fourth group there are no restrictions at all. It is the second category which is the most important at present, and about which the chemical industry must feel the gravest concern; it includes all those non-ferrous metals and chemicals which are not prohibited under the first head. Capacity is to be regulated as follows: "basic" chemicals, 40 per cent. of the 1936 production capacity; "other" chemicals, 70 per cent.; pharmaceuticals, 80 per cent. Annual consumption, including exports, of products containing non-ferrous metals is limited by the following tonnage quotas: copper, 140,000; zinc, 135,000; lead, 120,000; tin, 8000; nickel, 1750.

Beware of Haste

IT will be observed with interest, by those who scanned our leading article last week, that no specific mention, apparently, is made of dyestuffs. It is not stated (in any report we have seen) whether these are "basic" or "other" chemicals, and we feel that even the 40 per cent. level has its dangers at this stage of German political education. Certain commentators insist that at these levels Germany will certainly not be able to balance her budget in 1949—or at any time—and bring up the old argument about the impoverishment of Europe, and of the world in general, resulting therefrom. These critics are trying to achieve too rapid a recovery after a devastating war. We feel that the danger to-day is rather that Germany may be put on her feet again too rapidly, with the possibility of appalling results. Admitted we must suffer some inconvenience and some scarcity so long as German industry is kept below its maximum potential; this is surely better than repeating the mistake of 1919 and enjoying the temporary luxury of plenty while fostering yet a third conspiracy to lay waste the world. In these circumstances we are glad to read that the plan is subject to review by the Control Council. Germany's amazing power of recovery must not be fully engaged until the Nazi ideal has been utterly exterminated.

Budget Problems

WRITING of the £19 million by which revenue has exceeded the estimate and of the £371 million by which expenditure has fallen short, the City Editor of *The Times* describes such figures as "mere ha'pence." He thus puts the year's revenue returns and the coming Budget problems into a right perspective. From a business point of view it is essential to look further, both backwards and forwards, than the present Chancellor is likely to do in his statement to Parliament next week, or in the proposals by which he will settle the fate of the taxpayer for some years to come. The discussion should begin with a pre-war Budget of a single thousand million swollen to the maximum war-time expenditure of £6000 million. The increase was not entirely on account of the Fighting Services; indeed, normal Government expenditure was nearly doubled during the course of the war. The figure is difficult to state with precision, for the costs of food subsidies and many other social services were not in every case wholly attributable to the war. Of the £6000 million of total expenditure, more than half was raised by taxation, an achievement of which the business and taxpaying classes have every reason to be proud, and for which they receive none to liberal a measure of popular thanks. The proportion of the costs of war, paid as it were on the nail by the British taxpayer, exceeds the similar proportion in any other nation involved.

Excess Profits

THE discussion on the Excess Profits Tax, as those of our readers who remember the experience of twenty-five years ago will appreciate, is one-sided and inadequate. Mr. Dalton has succeeded in invading the impression that by a remission of E.P.T. he is, in fact, making a concession to industry, whereas, in fact, Excess Profit demands carry with them the obligation to refund deficiencies. After the last war the tax was maintained just so long as the Treasury could see a balance of surpluses over deficiencies and then promptly withdrawn; in other words, the tax was not taken off until it promised to be a charge on the Revenue rather than a source of income. Whether or not that situation has yet arrived is known only to the Treasury; but if it is the fact that E.P.T. can no longer serve the Chan-

cellor as a revenue producer, the business world is entitled to the credit for a great achievement, and might well ask to be left to face the trials of less prosperous days without the slur of a gift from the Treasury which, in fact, is no gift at all. The suggestion of a new tax on profits which, to quote Mr. Dalton's words last autumn, "would bring in substantially equal revenue," if read literally, presents no threat to anybody. The possibilities of E.P.T. having been exhausted, and the tax having ceased to contain the prospect of any revenue at all, the substitution of a new tax to produce equal revenue would not matter. There is, however, the dismal possibility that Mr. Dalton may endeavour to secure out of industry a sum equal to the excess profit after industry has ceased to show any such returns.

Nationalisation of Steel

BY the time our next metallurgical section is ready for press, the fate of the British iron and steel industry will probably have been sealed, and another cause of industrial uncertainty removed. As yet the Government has made no definitive decision, and Mr. Wilmot was unable to answer Mr. Boothby's question on the subject in the Commons on Monday. However, the rumour is afoot that, of the three courses open to them, the Government are in favour of acquiring the 20-odd combines which control some 90 per cent. of steel output, and of establishing a National Steel Board. This, while nationalising the main part of the industry, would apparently not involve State control of the ancillary engineering businesses of the great steel firms—at any rate not until the Government decides (if it ever does so decide) to nationalise the engineering industry in general. Intermediate between this whole-hearted proposal and the scheme which the Iron and Steel Federation regards with most favour—namely, the reorganisation of the industry from within, with Government supervision—lies yet another alternative. This envisages a new Government control over the industry, which would still remain in private ownership. The control would issue directions, and would have in reserve the threat of nationalisation. Such a plan, in our view, savours too much of the cat-and-mouse principle, and would give even less stability to the industry than may be expected from out-and-out nationalisation.

Atomic Energy in Industry

Discussion in the House of Commons

ON Thursday last week, the question of the industrial development of atomic energy was raised in the House of Commons by Mr. Martin Lindsay. He wanted to know, he said, what the Government was doing to develop it, over and above the appointment of a regulating committee, the establishment of a research station at Harwell, and the proposed introduction of a Bill to regulate the future development of atomic power. Who, he asked, was doing the central planning? Was it a sub-committee of the Cabinet, or the Lord President of the Council in his spare time? In view of the proposal of the Central Electricity Board to spend £300 million in the next ten years on power stations, which, he believed, would be out of date before their completion, he wondered what priority was being given to the consideration of the industrial use of atomic energy.

British Scientists' Work

Mr. Blackburn called attention to the fact that the whole of the fundamental research which led to the discovery of the fission of uranium emanated directly from the laboratories of Cambridge University and the work done by Rutherford, Aston, and Savage, and, in the main, the work done by British scientists. Referring to British coal as a "wasting asset," he quoted Dr. Oppenheimer (who was in charge of the actual construction of the atomic bomb) to the effect "that the installation to provide half a million or a million kilowatts in usable form . . . is not very far off."

Mr. Blackburn further stressed the need to exclude as much as possible of the atomic programme from military secrecy, especially as almost all the witnesses before the U.S. Senate Committee on atomic energy had agreed that the value of the "secrecy" of the atomic bomb would last no more than 12 months if a Power such as the Soviet Union was determined to produce such a bomb. Our co-operation with the U.S.A. in the peaceful development of atomic energy, Mr. Blackburn said, was most unsatisfactory. It was not logical for the U.S., on the ground of military security, to refrain from divulging to us information about the plutonium process, when we know how to construct a bomb of uranium 235.

Turning to the consideration of the materials from which atomic power can be produced, Mr. Blackburn noted that these comprise uranium and thorium, the latter roughly three times as common as uranium. The survey of the whole of the uranium and thorium of the British Commonwealth was

important, as it would enable control to be placed on these raw materials for atomic energy. He remarked that thorium was used in manufacturing gas mantles, and that the production of gas mantles in Britain was 20 or 30 million a year. In those gas mantles there are 10,000 kg. of thorium oxide, and therefore, he said, in the annual production of gas mantles in Britain there is sufficient thorium to produce a number of atomic bombs. The gas mantle industry in Britain obtains its thorium from the monazite sands of Travancore. The present concession is held by a company called Hopkin & Williams (Travancore), Ltd., in which a substantial interest is held by I.C.I. These supplies of thorium were described as being three-quarters of the world's supply before the war. Mr. Blackburn hoped that all steps had been taken to acquire, on behalf of H.M. Government, all the uranium and thorium which exists in the British Commonwealth and Empire.

The Government's Reply

Replying, the Minister of Supply (Mr. John Willmot) said quite definitely that the problem of harnessing the energy of the atom for peaceful purposes had not yet been solved; he cited, as an example of the difficulties involved, the question of corrosion, which becomes most serious as soon as one gets into the necessary high temperatures. Nevertheless, he said, there was a term even if a long one, to the availability of conventional fuels, and this country must take its place in the preparation for a worldwide economic revolution which the development of atomic power must herald. It was along the line of power production that progress was likely to flow. As much of the resources of this country as can be made available is to be devoted to this work, the central planning of which was in the hands of the Prime Minister and the Cabinet, assisted by the Advisory Committee presided over by Sir John Anderson. The money the Government is prepared to spend in this direction was bounded by a physical, not a financial limit. Besides the research station at Harwell, accommodation had been found for the designing team at Risley, near Warrington, while the M.O.S. factory at Springfield, near Preston, had been selected as the site for the subsidiary plant for the processing of materials.

In reply to Major Roberts, Mr. Willmot said that the industrial application of nuclear energy was not a matter of military security; and that there was no immediate danger of not needing coal.

London's Chemical Industry

I.—Sulphuric Acid in East and West Ham

by W. A. PARKS, B.Sc., and E. A. RUDGE, Ph.D., F.R.I.C., A.M.I.Chem.E.

CHEMICAL industry forms a large part of the total industrial activity of the adjoining County Boroughs of West Ham and East Ham, the concentration being most marked in West Ham, where some 30 per cent. of the working population, in 1931, found their employment in chemical and related trades. Within this group of trades can be found examples of a wide variety of processes, not the least important of which is the manufacture of sulphuric acid. There are four substantial acid works situated in the space of about six square miles.

The commercial development of the contact process in this country is intimately linked with the firm of Spencer Chapman and Messel of Silvertown. The forerunners of this firm were Dunn, Squire and Co., who were in business in Stratford as chemical manufacturers before 1872, probably on the site now occupied by Thomas Tyrer & Co. Dunn remained there until 1890, but Squire moved to Silvertown in 1872 to be joined by Rudolph Messel, a young German chemist who already had some industrial experience in his own country.

Just previous to this time, Graebe and Leibermann had succeeded in synthesising alizarine from anthracene. The second stage of their later method involved the sulphonation of anthraquinone, and for this purpose a good oleum was required. While in Germany, Messel had had his attention drawn to this process, and to the shortage and high price of the necessary oleum. On joining the new Silvertown works of the firm, now Squire, Chapman and Co., he turned his attention with Squire, to the development of Peregrine Phillips' contact process for sulphuric acid. Phillips' process had never been a success, mainly because of the poisoning of the platinum catalyst. Faraday had already noticed the necessity for the perfect cleanliness of the platinum plates which he used for effecting the union of hydrogen and oxygen. Moreover, he had also shown that various impurities in the gases could inhibit the action of the plates. Squire and Messel, and, quite independently, Winkler, had ascribed the failure of Phillips' method to his inability to obtain the reacting gases in a pure form.

Well-Known Patent

The work in which they engaged led to their well-known patent of 1875. This patent proposed to decompose sulphuric acid by passing the vapour over a highly heated surface. The resulting gases were then dried, and the very pure sulphur dioxide and

oxygen thus obtained were passed over a catalytic mass. This, in the early stages, was spongy platinum, or pumice impregnated with platinum, heated to a low red heat.

In 1878 a further patent of Messel's appeared. Again, the motive is clearly that of preparing pure constituents, for the materials used were sulphur, and oxygen prepared by the electrolysis of water. Messel suggested that the hydrogen could be carburetted and used as an illuminant. The process was not a commercial success, and, as most of the records of the firm were destroyed by enemy action in 1940, it is not possible to state to what extent it was tried. The writers were informed, however, that a certain plant, now dismantled, was referred to by old employees as the "electric plant."

Increased Production

It was in the same year, 1878, that Messel succeeded Squire as managing director of the firm, which adopted its present style of Spencer, Chapman and Messel, Ltd. The production of the firm rapidly increased. In 1887 12,249 tons of 90 per cent. acid were produced. In 1889, when the production had risen to 16,682 tons, the foundation stone of a new chamber plant—the "May Chambers"—was laid by Princess May, the present Queen Mother. Later, as a result of war demands, the output rose, until in 1916, the year of Messel's retirement, it was 40,000 tons. In 1939 it was some 62,000 tons.

This increase of production was accompanied by many changes in the demand for the product. In the early days, among the main customers of the firm were the British Alizarine Company (who rented land adjacent to the acid works); the Royal Gunpowder Factory at Waltham Abbey; most of the gasworks in Southern England; oil refineries, and the galvanising trade.

The policy of Spencer, Chapman and Messel has always been to adapt current practice to suit their own circumstances. Contact plants have been working side by side with various forms of chamber plant, and this firm was one of three in the country capable of producing oleum before 1914. In 1887 Rio Tinto pyrites were being burnt for use in a Badische plant. In 1939 there were three contact plants using pyrites, three burning sulphur, together with two chamber plants also on sulphur, but at the present time the sole supply is Texan sulphur. In the matter of catalysts, all have been tried. An experimental plant of Dr. Messel's, in which he investigated various catalytic materials, was only recently discarded.

The use of vanadium pentoxide began in 1923. Previous to that year, platinised asbestos had been mainly used. This was found to have three disadvantages: losses are heavy when recharging of the converter takes place, owing to the mechanical difficulties of handling the light material; it is very sensitive to poisons; and it has a low specific heat. This last point is important when a temporary stoppage takes place, for the temperature of the catalytic mass falls very rapidly below the minimum required for conversion (about 300°C). Vanadium pentoxide, on the other hand, is less susceptible to poisoning, has a much higher specific heat, and is easier to handle. In spite of the fact that its temperature of operation is somewhat higher than that of platinum, Spencer, Chapman and Messel have decided that it is worth while to employ the vanadium catalyst. One of their plants employing this material was in continuous use for ten years, until its destruction by air attack in 1940, and the managements had every reason to believe that it would have continued in operation for another five years.

There is also in use at the present time a lead chamber plant using Mills-Packard conical towers. The acid from this can be brought up to 96 per cent. H_2SO_4 by using it as the circulatory acid in the contact plants, but is usually disposed of direct as "B.O.V." 70 per cent. The demand for

this district capable of making oleum, and although the demand for this product has lessened, many manufacturers require a good quality water-white 96 per cent. acid. Modern contact plants lend themselves to this production and avoid the costly concentration apparatus required as an adjunct to the chambers. Recently, two other firms in this district, the Gas Light and Coke Company at Beckton, and F. W. Berk and Co., Ltd., at Stratford, have added contact plant to their equipment.

In the case of the Gas Light and Coke Company, a wet contact plant was erected at the Products Works in 1937. This uses the mixture of H_2S and CO_2 , recovered from the ammoniacal liquor of the gas works after the ammonia has been removed. The H_2S is admixed with air and burnt, and the resultant gases are passed over a vanadium catalyst, and condensed to a 94/95 per cent. acid. In 1938, F. W. Berk and Co. installed a raw gas contact plant built by Simon-Carves, of Stockport, on the Monsanto principle. In this, Texan sulphur is first melted and then forced into a burner where it is burned in dry air. Two vanadium pentoxide converters are used, into which are passed the cooled gases, the resulting 80, being absorbed in concentrated acid. A second plant on similar lines was installed in 1942.

These firms have been manufacturing chamber acid since the 1870's and in their history can be traced the gradual change

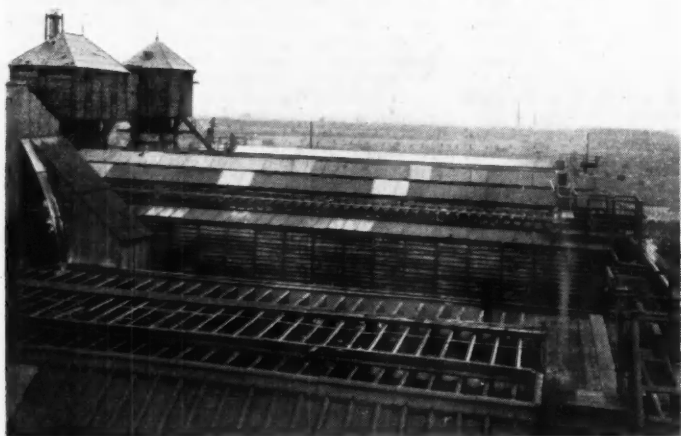


Fig. 1. The Gas Light and Coke Company's Tar and Ammonia Products Works, Beckton. General view across the top of the sulphuric-acid chambers. Gay-Lussac towers in the left background.

oleum, in the London area, is now less than it was in the pioneering days of the firm. When required, the fuming acid is made in a separate absorbing tower, using as absorbent the 98 per cent. acid from the main plants.

For many years, as stated above, Spencer, Chapman and Messel were the only firm in

in favour of the contact process which has been taking place in recent years. In 1924 less than 5 per cent. of the total acid produced in this country came from contact plants, but in 1939 nearly 38 per cent. was so produced, and during the war years of 1939-45 this figure has increased to about 50 per cent.

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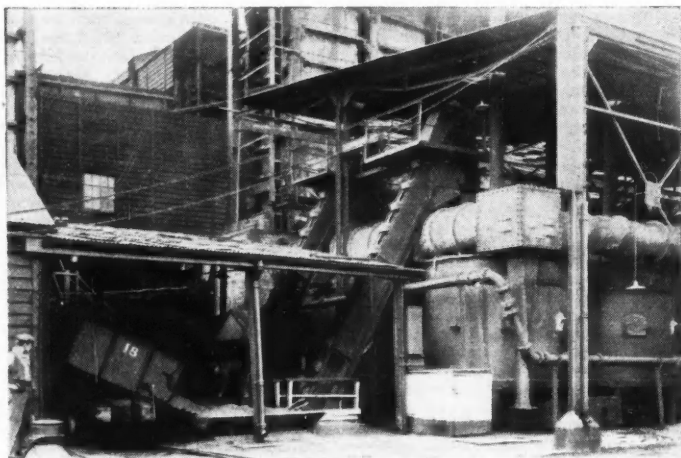
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Owing to war damage, F. W. Berk and Co. have discontinued, for the time being at any rate, the manufacture of chamber acid. Previously, they show a long period of experiment with new devices and procedure. This firm took over the site and business of Thomas Bell in or about 1873. By 1890 iron pyrites and Sicilian sulphur

installed this system during the period of the 1914-18 war, but discontinued their use after having considerable trouble owing to corrosion at the water troughs on the outside. They attribute this to the hard water of the London area. They also introduced Schmiedel boxes into their lead chambers. These leaden boxes contained

Fig. 2. Unloading and elevating spent oxide at the Gas Light & Coke Company's Products Works. Two Glover towers are seen at the back.



were being roasted in hand-operated burners, and the gases passed into lead chambers. At the beginning of the present century a 95 per cent. acid was being produced in Stratford by concentrating the chamber acid in glass retorts set in beds of sand. The firm claims to be the first user of the Webb concentrator, which consisted of enamelled iron vessels arranged on the cascade principle. In 1904 the Kessler Volvic lava concentrator was installed. In this, hot gases from an anthracite stove were bubbled through the acid as it passed from one tray to another. Later, in 1908, the Benker concentrator, involving a cascade of silica or silicon iron basins, was used.

In the development of chambers, also, the general tendencies of the period can be traced in the histories of these firms. The Anglo-Continental Guano Works, of Silvertown, began making acid for their superphosphate works in the 1880's with chambers 16 ft. high, and with steam introduced. As the need for cooling became more fully realised, water was introduced instead of steam, while the chambers were increased in height. In 1919 they were raised to 20 ft., and in 1925 to 25 ft. The Beckton works installed a circular chamber of a French design in 1887, and this is still in use. Spencer, Chapman and Messel are still using the Mills-Packard conical towers with external water cooling, while Berk and Co.

acid to a predetermined level, in which serrated rollers rotated, so as to splash the acid up into the chambers in a fine spray, thus intensifying the reaction.

Development of furnaces has followed the change in the use of raw materials and the invention of improved mechanical devices. The first use of pyrites on a large scale is attributed to Thomas Farmer, of Kennington, in 1839. Brimstone had largely gone out of use in this country by the middle of the 19th century, owing to the rising price of sulphur—the result of monopolistic activities. Many patents for the use of alternative domestic sources of sulphur were taken out in the century 1750-1850, but, up to 1939, rather less than half of the sulphur consumed was in the form of imported pyrites. A considerable increase in the use of zinc concentrates which took place in the years immediately preceding the war was largely at the expense of brimstone. The increased production and excellent purity of Texan sulphur has, however, led to a large increase in its use of recent years, especially by contact manufacturers. For example, in the first half of 1945, 40 per cent. of all acid made was produced from sulphur, compared with 15 per cent. ten years earlier.

Both Spencer, Chapman and Messel, and F. W. Berk and Co. use Texan sulphur; the former in a rotary furnace, the latter in their new burner described above. The

Anglo-Continental Guano Co. used spent oxide between 1919 and 1925, but returned to pyrites, with mechanical burners, in the latter year. The effect of the recent war on the supply, or possible supply, of Spanish pyrites is reflected in the reversion of this firm, in 1941, to spent oxide. This necessitated an alteration in the design of their Herreshoff burners, two of the five shelves being removed to give a greater combustion area. The Gas Light and Coke Company began their acid making in 1879, using hand-operated shelf burners and pyrites. This went on until 1910, when they began using their own spent oxide in modified Herreshoff burners.

The Ostwald Process

For the supply of nitrous gases, all these chamber plants formerly depended upon nitre pots. In 1908-9, however, the Gas Light and Coke Company instituted research which led to the installation, some five years later, of the ammonia oxidation plant, whereby ammonia from their own liquor was oxidised to nitric acid by passing with air over a platinum gauze catalyst. Early in 1915 the use of nitre at the Gas Light and Coke Company's products works at Beekton was discontinued, and all their nitrous acid requirements for their chamber plant have been produced by the oxidation of ammonia since that date. This was the first application of the Ostwald process commercially in this country, and during the following years the plant was inspected by many British acid makers, when information about the process was freely given, and the process was generally adopted during the 1914-1918 war. This pioneering work was described in the *Chemical Trade Journal* of March 2, 1919. A similar type of apparatus was installed by the Anglo-Continental Guano Company in 1928, using ammonia solution imported from the gasworks. An interesting experiment was conducted by the same firm in 1913, when they tried spraying sodium nitrate solution into the chambers. This was not successful, owing to the clogging action of the sodium sulphate, and the presence of free nitric acid in the product.

The Gas Light and Coke Co. also tried the experiment of using sodium nitrate direct in their acid plant. The circular chamber on a French design, built in 1887, was fitted with a nitration tower which followed the Glover tower, and down this was trickled a weak solution of sodium nitrate. This worked successfully for some years, but was discontinued owing to the contamination of the acid with sodium sulphate.

From the foregoing it may be seen that the managements of the four firms described have contributed their full share to the development of acid making in this country.

The authors desire to acknowledge, with grateful thanks, the assistance afforded them, by the four firms mentioned, in the assembling of the material for this article.

Digest of Statistics

Chemical and Allied Figures

CONTINUED variation in production figures for the chemical industry is shown in the third issue of the *Monthly Digest of Statistics* (H.M.S.O., 2s. 6d. net), published this week.

Although production of sulphuric acid (in thousand tons) rose from 145.2 in November last to 153.9 in December, it fell to 147.8 in January. On the other hand, superphosphate production, which dropped from 81.8 in November to 76.0 in December, rose in January to 98.4, and the production of compound fertilisers, which went down from 110.7 in November to 97.9 in December, increased to 102.2 in January. The January consumption of pyrites (again in thousand tons) was 17.4, as against 17.9 for December and 16.4 for November. Consumption of sulphur for the manufacture of sulphuric acid in January was 14.6, although in December it was 15.0. Phosphate rock consumption showed an increase from 65.5 in December to 67.8 in January. The consumption of basic slag also went up, the January figure being 52.4, as compared with 45.7 for December.

Stocks of pyrites declined progressively from 97 (thousand tons) in November and 89 in December to 79 in January. There was also a consistent drop in the stock figures for sulphur for sulphuric acid manufacture, the respective totals for the three months being 66.0, 61.8 and 47.9, while ammonia stocks, excluding ammonia produced in by-product factories and converted directly into ammonium sulphate, stood in January at 5.66, against 6.77 for December.

Iron-ore production (also in thousand tons) went up from 231 in December to 245 in January and reached 256 in February. Pig-iron production showed less variation, the respective figures for the same three months being 145, 144 and 146. Figures for virgin aluminium production rose from 2.48 in November, and 2.61 in December to 3.09 in January (the February figures are not given), while consumption varied from 7.9 in November to 5.9 in December and 7.1 in January.

Employment Figures

The estimated number of people employed in chemical, explosives, coke-oven and by-product works (figures in thousands) declined again, the totals for November, December and January respectively being 249.0, 238.4 and 235.9. Of the last-mentioned figure, 91.6 were females. In the iron and steel industry the numbers employed in January are given as 189.5, which is the same as the December figure, while in non-ferrous metals the numbers employed dropped slightly, from 78.4 in December to 78 in January.

"Industry and Research"

F.B.I. Two-Day Conference in London

THE two-day conference on "Industry and Research" which was held under the auspices of the Federation of British Industries at Kingsway Hall, Kingsway, London, last week, was an undoubted success, so much so that in summing up at the end, Sir William Larke expressed the hope that it would not be the last of its kind. He pointed out that the close collaboration that had been established between science and industry in war time must be maintained and developed in order to ensure the industrial development of this country.

Representatives of organised industry and those who are leading and directing industrial research came together to discuss their common problems in the application of science by industry and the part that research is playing, and can play, in promoting industrial efficiency, exports, full employment and a higher standard of living.

The feelings of the conference were ably embodied in a series of resolutions which were submitted by Sir William Larke at the close and carried without dissent. These resolutions urged every industrial concern to make the greatest possible use of scientific knowledge directly it becomes available, in order to maintain technical pre-eminence in design, quality, and production; to engage a qualified official or officials with the specific duty of following general scientific and technical developments and literature; and to join and make the fullest use of its appropriate research association, and, where practicable, to establish its own research department.

Educational Facilities

Two further resolutions placed it on record that an essential factor in pursuing these aims is the provision of increased facilities in educational establishments for training scientific and technical personnel and urged industrialists to stimulate such provision in their own field of interest; and urged the Government to give the highest priorities to the provision of essential buildings and personnel for research.

Sir Clive Baillieu, president of the F.B.I., was in the chair at the opening session on Wednesday morning and in an address urged that our national slogan must no longer simply be "Britain delivers the goods," but also "Britain creates the goods."

The opening address was delivered by Sir Robert Robinson, president of the Royal Society, who said there was an increasing and very welcome tendency for the larger establishments to embark on basic scientific research, but it would usually be found that

there was an industrial objective, although possibly a distant one. Really blind research, industrially speaking, was better left to the universities in present conditions.

Further introductory addresses on general lines were given by Sir William Larke, director of the Iron and Steel Federation and chairman of the F.B.I. Research Committee, who dealt with "Industry's Part"; Sir Harold Hartley, who spoke of "Industrial Research in Action" and Sir Ernest Simon, chairman of the Council of Manchester University, who described "The Part of the Universities."

Value of Quality

The afternoon session on Wednesday was devoted to the subject of "Scientific Research and Production," the chair being occupied by Mr. John Wilmot, M.P., Minister of Supply. In the course of a paper on "Research and Quality," Dr. J. R. Hosking, director of Research and Development, Paints Division, I.C.I., Ltd., pointed out that quite small differences in the quality of a chemical, or the behaviour or appearance of a finished product, might be of immense importance when it came to marketing. He gave detailed illustrations of how research might be utilised for the improvement of quality by referring to two closely associated industries—the synthetic resin and the paint industries. A paper on "Research and Production Costs" was presented by Mr. A. Healey, director of Production, Dunlop Rubber Co., Ltd.; and the concluding paper of the session, on "Conversion of the Results of Research into Production," was presented by Dr. C. C. Paterson, O.B.E., F.R.S., head of the research laboratories of the General Electric Co., Ltd. There was a lively discussion, followed by a brief address by the Minister of Supply.

Mr. Herbert Morrison, M.P., gave an address at the morning session on Thursday, when the general subject was "Scientific Research and Industrial Expansion." Mr. Morrison declared that perhaps the greatest problem facing industry during the present transition period was the shortage of man-power to operate the additional capacity resulting from expansion. One method by which science could help in solving this was by devising instruments to help in the mechanical control of industrial processes. He said the larger firms could look to their own research departments for the solution of their research problems, but a fully equipped and properly staffed research department cost a good deal of money and was beyond the resources of many of the

smaller firms. He urged all firms who were seeking scientific knowledge to make full use of the D.S.I.R.

"How New Industries Arise" was the subject of a paper presented by Dr. R. E. Slade, M.C., lately Research Controller, I.C.I., Ltd. In a historical survey he described how the starting of one industry led often to the beginning of another, as when developments in the textile industry led to the building up of the heavy chemical industry on the Mersey. He also spoke of research in this country in relation to the setting up of new industries in other countries, often to this country's disadvantage. In this connection he referred to the way in which Perkin started the synthetic dye industry, based upon discoveries made by scientific research, and said the same scientific industrial principles were used by the professors of Heidelberg University, who started a dye industry based upon laboratories where science was used in solving the works problem.

A Tendency to be Avoided

Mr. C. H. Davy, chief research engineer, Babcock & Wilcox, Ltd., presented a paper on "Modernisation of Processes and Plant" and Mr. A. J. Philpot, C.B.E., director of the British Scientific Instrument Research Association, dealt with "The Part Co-operative Research Can Play." A discussion was opened by Sir Henry Tizard, K.C.B., F.R.S., who said there had never been a time when the prestige of the scientist was greater and his value to the nation more observable, but scientists should avoid the tendency to overplay their hands. There was a danger of far fewer people doing actual work and more being engaged in telling them how to do it.

The afternoon session on Thursday, when the general subject was "The Application of Research in Industry," was presided over by Sir John Anderson, M.P., who, in an address, said that on the whole the attitude of industry towards science now left little to be desired. The financial position was easier, too, but there was still much to be learned about the technique of conducting and applying research in industry. As a result of grave defects in our higher educational system, we had created a community in which, outside the ranks of the specialists, far too few people had any scientific training at all. Not only had there been lack of co-ordination between the universities, leading to what Mr. Churchill had once called "overlaps and underlaps," but too little contact between universities and industry, with the result that we lagged behind other countries in the number of scientists and technicians available to industry. These were matters in which the central Government must take a hand. A Minister of Science, or a Ministry of Science, was a

wholly mistaken conception, but some one Minister should be designated and equipped with the necessary staff to deal with scientific problems beyond the scope of departmental responsibilities, and the obvious Minister for this purpose was the Lord President of the Council.

Two papers were presented, one on "The Firm With a Research Department," by Dr. P. Dunsheath, president of the Institution of Electrical Engineers, and the other on "The Firm Without a Research Department," by Sir E. Raymond Streat, chairman of the Cotton Board. There was a keen discussion, initiated by Sir Robert Pickard.

New Laminating Resin

Low-Pressure Type Developed by I.C.I.

THE development of a new type of synthetic resin is announced by the Plastics Division of Imperial Chemical Industries. This resin has been designed for use as a contact or low-pressure laminating resin, and, in addition, has possibilities for general-purpose impregnating and casting. British manufacturers have long felt the need for home-produced "contact pressure" resins of this kind. Their value for special applications was early recognised, and in America they have been widely used, especially by the aircraft industry. Until now, work on them has largely been kept secret.

The new resin makes possible the production of large tough laminates of complicated design with simple equipment and at economic cost. For that reason, a wide range of applications is forecast for it. Not only the electrical, furniture and allied trades, but also the shipbuilding, motor and aircraft industries are expected to provide important outlets.

Contact pressure resins are especially suitable for the construction of shaped laminated articles, making use of fabric or paper. Where great strength is required, glass fabric has been found to give good results. A mould or former is required, on which the shaped article is built up, and the very light pressure needed can easily be applied by the rubber bag technique. With shaped articles, the fabric is cut into tailored pieces, so that it fits closely to the "former" without creases. The resin, which is a brown viscous liquid, has a small quantity of catalyst added to it before use, and is then applied to the fabric by brushing or impregnating in a bath. A resin content of from 40-50 per cent., depending on the fabric, is usually employed. Curing takes up to half an hour at a temperature of about 100° C.

Preservation of Wood*

Operation of the Open-Tank Treatment in Sweden

by BROR HÄGER

THE Boliden Mining Company in Sweden produces a large quantity of white arsenic. Knowing that arsenic compounds are very active against wood-destroying fungi and insects, this company started, at the beginning of 1933, large-scale research on wood preservation to develop a preservative based on such compounds. The aim of the preliminary investigation was to find out which compounds could be used. Many of the arsenic compounds were found to be too soluble and many too expensive to be used as wood preservatives. Therefore, most of these compounds could be eliminated and only a comparatively small number of inorganic salts were left to be considered as possible preservatives.

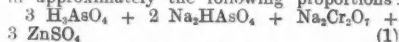
Investigations in respect of resistance to leaching made it evident that the usual requirements are much too low, if the treated wood is intended for outdoor use. For such purposes the preservative must be extremely insoluble, but still sufficiently active against wood destroyers. Only a few arsenates were found acceptable, whereas the corresponding arsenites, although very active, did not show sufficient resistance to leaching. This is explained by the fact that arsenic acid is much stronger than arsenious acid, so that the former gives more stable compounds.

Formation of Active Arsenates

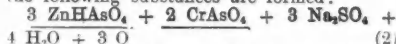
After having established the foregoing facts, the most difficult problem to be solved was how to introduce the preservative into the wood. The preservative should be in a water solution and after this solution has penetrated the wood the chemicals of the preservative should react to form insoluble but active compounds within the wood substance. A precipitation by means of a double treatment was tried, but was found too expensive and did not give good penetration or distribution of the preservative. To use acetic acid or ammonia as a solvent for the preservative, to be subsequently evaporated, was found expensive and it was difficult to remove this solvent completely from the impregnated wood to prevent subsequent leaching. The leaching resistance therefore was not good when using solvents of this character. The only advantageous way found was to cause a precipitation of the preservative in the wood through a chemical reaction either with the wood substance itself or by other means. Several such reactions have been investigated. The method which has been found the best is the following:—

An impregnating solution is made up of

arsenic acid, sodium arsenate, sodium bichromate, and zinc sulphate dissolved in water. The arsenic acid, both as such and in the arsenate, is the main active agent against wood-destroying fungi and insects. By their reactions with the wood, the other components in the solution transfer the active chemicals into insoluble compounds, thus fixing them and preventing subsequent leaching. The zinc sulphate used in the salt mixture as a fixing agent has also an effect of its own on wood destroyers. The chemical reactions are complicated, but the following formulas give the principle. The impregnating solution contains the chemicals mentioned in approximately the following proportions:



After the solution has entered the wood the bichromate reacts with the reducing substances contained in the wood, whereby the following substances are formed:



The arsenic acid is thus precipitated as zinc and chromium arsenates, which are underlined in formula (2).

In practical work, the impregnating solution is introduced into the wood by either an open-tank method or a full-cell pressure treatment. The open-tank treatment has been investigated thoroughly by the Boliden Company and is now used to a large extent in Sweden. An open-tank plant can be constructed cheaply and run economically, even when the capacity is comparatively small. Small plants, situated either at the places where the lumber or the timber to be impregnated is produced or where it is consumed, reduce the expenses of wood transport to the minimum. The open-tank plants have been used when a capacity of up to 20,000 cu. ft. per month is required. The limit, however, naturally varies according to local conditions.

Two Tanks Used

Ordinarily, the open-tank treatment is carried out in two tanks, which are worked alternately. The charging of the wood and the subsequent steaming is carried on in one of the tanks while the impregnation is going on in the other. The treatment is briefly as follows: The wood to be treated is placed in a tank covered with a lid and low-pressure live steam is turned on. After the steaming period, cold impregnating solution is pumped into the tank, completely submerging the wood. During this period the wood absorbs the solution and normally the whole sapwood is penetrated. When the wood has

* *The Anglo-Swedish Review*, February, 1945, p. 27.

been long enough in the solution, it is lifted out and laid to dry in the open air. During the drying, the chemical reactions continue and are completed in a few days, after which the arsenates are fixed in the wood substance. The duration of the different treating operations varies with the dimensions and the kind of timber treated. Poles and sleepers are generally steamed for 10 to 12 hrs. and are submerged in the solution for 24 hrs. For smaller sizes of lumber and sawn timber much shorter treating periods are needed.

Effectiveness of Treatment

This simple treatment of seasoned wood is much more effective than is generally supposed. This is shown by the fact that Swedish pine generally absorbs about 16 lb. of the solution per cu. ft. of wood. The sapwood content in Swedish pine used for poles is about 60 per cent. and this sapwood is completely penetrated by the solution. The amount of arsenic acid (As_2O_5) in the solution is normally kept at 1 to 1.2 per cent. and, after treatment, the sapwood contains an average of nearly 1 per cent. by weight of arsenic acid, calculated on dry wood substance.

Because of the resistance of the wood to the penetration of the solution, the amount of the preservative absorbed per unit of wood is naturally higher in the outer layers than in the inner layers, although the amount there is more than sufficient to give the toxic effect desired. An investigation of 2000 poles treated for the Royal Administration of Swedish Telegraphs shows the remarkably good distribution of the preservative obtained by this treatment. Official samples taken from different parts of the sapwood in these poles showed a concentration of arsenic acid in the middle third of the sapwood of 55 per cent., and in the inner third of 40 per cent. of the concentration in the outer third. These results show that an open-tank treatment carried out in the manner described gives very satisfactory results.

The open-tank treatment has been used commercially in Sweden since the end of 1935. At present there are 11 open-tank plants spread over the country which use the Boliden preservative only. Most of the plants have been built by forest companies. The plants are in operation generally for about six months during the year.

The Boliden preservative can, however, also be used to advantage in pressure plants and such are preferred when a greater capacity is desired. A simple full-cell treatment is then used. The impregnating solution does not attack iron; on the contrary, it has corrosion-protective properties and no special precautions are therefore required to protect the iron parts of the equipment.

Ordinarily, but not always, the wood absorbs more of the solution when using pres-

sure treatment than by open-tank treatment. The amount of solution normally absorbed by Swedish pine is at least 20 lb. per cu. ft. of wood. The concentration of the solution is regulated so that the same amount of the salt is absorbed by the wood when either the open-tank or the pressure treatment is used. When using full-cell treatment the concentration of the arsenic acid in the solution should be about 0.9 per cent. Swedish pine requires an amount of salt corresponding to 0.15 to 0.19 lb. of As_2O_5 per cu. ft.

In Sweden, thus far, only one small pressure plant has been built exclusively for the use of the Boliden preservative. In some of the existing creosote pressure plants, however, the Royal Administration of Swedish Telegraphs has treated a large volume of poles during 1940 using the Boliden preservative. In Norway one pressure plant, where formerly only creosote was used, has, since 1938, used the Boliden preservative exclusively. During the year 1940 about 1.5 million cu. ft. of wood have been treated in Sweden with the Boliden preservative.

Regardless of the method of treatment, it is necessary to dry the wood afterwards. It thereupon turns a pale green colour from the chromium arsenate. The wood treated with the Boliden preservative can be handled without any danger and it is completely odourless. The treatment does not prevent subsequent finishing of the wood by painting or otherwise; the mechanical strength is not impaired; and the wood becomes somewhat resistant to ignition. To warm-blooded animals, wood preserved with the Boliden preservative is without danger of poisoning. This has been proved both by special investigations carried out by Professor Germund Wirgin and Dr. Bertil Groth of Stockholm, and by five years' practical experience.

Fungicidal Attacks Repelled

The fungicidal properties of the Boliden preservative have been investigated by the wood-block method, which has shown that the attacks of *Coniophora cerebella* (the cellar fungus), *Lentinus squamosus* (the cross-tie fungus), *Polyporus vaporarius*, and *Merulius lacrymans* are prevented by the Boliden preservative when the content of the salt, figured in percentage of As_2O_5 based on dry wood substance, is 0.05, 0.08, 0.06 and 0.05 respectively. According to these figures, the margin of security against ravages of fungi for wood treated with Boliden's preservative in the normal way is about ten-fold. Other important fungi have also been tested with similar results.

To investigate the resistance of the preservative to leaching, small wood blocks, 1.5 cm. by 2 cm. by 5 cm. in size, have been impregnated and dried and then leached intensively in running water, according to a standard method used by the Boliden Company. According to this method the treated

wood blocks are dried for 20 days, after which they are saturated with water (using vacuum) and then placed in a 1-gal. flask through which 400 c.c. of water per minute is running. Several blocks are tested at the same time and after intervals of 2, 15 and 30 days or more some of the blocks are taken out and analysed. The results are plotted in a leaching curve.

This leaching test is very severe and many salts which are usually designated as insoluble, as for example, calcium arsenate,

smallness of the pieces, reliable results are obtained within a comparatively short time.

Several kinds of wood have been investigated, including pine, spruce, birch, and beech. Before the end of 1936 more than 1100 such test pieces were placed in the ground at these two fields. The comparative results from the test field in Skane in the southern part of Sweden, with pine wood treated with the Boliden preservative, zinc chloride, sodium arsenate, and creosote are given in the accompanying table.

Preservative	No. of specimens	Lbs. of preservative per cu. ft.	Date of placing in ground	Number destroyed at Sept. 30, 1940
Boliden salt	10	0.144 As_2O_3	Sept. 21, 1936	0
Boliden salt	10	0.288 As_2O_3	Sept. 21, 1936	0
Boliden salt	10	0.47 As_2O_3	Sept. 21, 1936	0
Sodium arsenate	10	0.194 As_2O_3	Aug. 3, 1935	9
Zinc arsenate	10	0.275 As_2O_3	Aug. 3, 1935	0
Chromium arsenate	10	0.265 As_2O_3	Aug. 3, 1935	0
Zinc chloride	10	0.25 $ZnCl_2$	Aug. 3, 1935	8
Zinc chloride	10	1.475 $ZnCl_2$	Aug. 3, 1935	4
Creosote	10	12.3 Creosote	Aug. 3, 1935	0
Creosote	10	7.4 Creosote	Aug. 3, 1935	0
Creosote	10	7.0 Creosote	Sept. 21, 1936	0
Creosote	10	11.6 Creosote	Sept. 21, 1936	0
Creosote	10	15.8 Creosote	Sept. 21, 1936	0
Untreated heartwood	10	—	Sept. 21, 1936	1
Untreated sapwood	14	—	Aug. 3, 1935	14
Untreated sapwood	16	—	Sept. 21, 1936	16

¹ Zinc and chromium arsenates are contained in the Boliden salt.

² 9 heartwood pine pieces are still remaining but are badly attacked.

³ The average life of untreated sapwood was 27.8 months

are easily leached out in this way. Leaching during 30 days in the manner described thus reduces calcium arsenate to only 2.2 per cent. of the original content. The leaching curve for this tardily soluble salt is by this leaching method found to be about the same as the curve for soluble salts, for instance, sodium arsenate, although a less severe test shows a great difference between these two salts. Both of them are evidently not sufficiently resistant to leaching to be used as wood preservatives.

Leaching tests carried out in this way give consistent and reliable results. The amounts of arsenic acid remaining in the wood treated with Boliden salt after 2, 15, and 30 days of leaching were respectively 80, 87, and 64.7 per cent. of the original content. Tests carried on for five months have shown that only a small additional percentage is leached out between 30 days and 5 months.

These very important laboratory tests give a good picture of the quality of the different preservatives. The crucial test, however, has to be carried out in the field. Such field tests for testing the treated wood against decay have been going on since the beginning of 1935 at two places in Sweden. Test pieces, 1.5 cm. by 2 cm. by 75 cm. in size, of sapwood treated with the Boliden preservative with different retentions have been placed in the ground, together with pieces of the same size treated with other preservatives with different retentions, as well as untreated sap and heartwood controls. Because of the close contact with the soil and the

Wood treated with the Boliden salt has proved to be resistant to termites and marine borers (*Teredo*).

Tests against termites have been carried out in Australia, South Africa and India. Pieces of pine sapwood, 4 cm. by 4 cm. by 60 cm. in size, double treated with zinc arsenate and chromium arsenate placed in the ground in South Africa in May, 1936, are still completely unattacked, whereas untreated specimens were attacked after three months and were destroyed completely in August, 1938. Another set of smaller test pieces were placed in August, 1937, of which the untreated specimens were completely destroyed in August, 1938, whereas the pieces treated with Boliden salt are still intact.

Tests to investigate the resistance against marine borers are being carried out at the harbour of Gothenburg, at Kristinebergs Zoological station at Fiskebäckskil (both on the west coast of Sweden) and at the Polytechnic University at Trondheim, Norway. At these places, the wood treated with the Boliden salt has proved quite resistant. The tests in Sweden have been under way for more than six years, and the tests in Norway for three years. Some tests with 6-ft. poles have also been carried out in the Panama Canal zone with equally good results.

The Boliden preservative is being investigated further in Sweden by the Government Testing Institute and, in the United States, at the Forest Products Laboratory in Madison, Wis. The last-mentioned investigation consists of extensive field tests.

Personal Notes

The Executive Council of the Imperial Agricultural Bureaux has elected as its chairman LIEUT.-COL. J. G. ROBERTSON, the representative of Canada.

MR. D. B. WHITFIELD, a director of Todd Bros., Ltd., St. Helens and Widnes, has been returned unopposed as a "non-political" councillor for the Cronton division of Whiston R.D.C., Lancashire.

MR. J. DAVIDSON PRATT, O.B.E., director and secretary of the A.B.C.M., is a member of the F.B.I. mission, headed by Sir Guy Locock, which has gone to Denmark to discuss Denmark's import requirements and how far Britain can meet them.

PROFESSOR B. T. P. BARKER, who has been chairman of the Microbiological Panel of the S.C.I. Food Group for the past three years, has retired from that position, and PROFESSOR H. D. KAY, F.R.S., has been appointed in his place.

DR. W. H. COATES, of I.C.I., Ltd., has been appointed a member of the advisory committee set up by the Board of Trade in connection with the census to be taken in 1948 in respect of production in the year 1947.

PROFESSOR GILBERT W. ROBINSON, Professor of Agricultural Chemistry in the University College of North Wales, and Director of Soil Surveys for England and Wales, is visiting Spain and Portugal under the auspices of the British Council for a short period to lecture, at the invitation of scientific organisations, on agricultural and soil science subjects.

MR. C. M. WHITTAKER, B.Sc., was elected president of the Society of Dyers and Colourists, in succession to Dr. C. J. T. Crenshaw, at the annual meeting on March 29. Mr. Whittaker is a director of Courtaulds, Ltd., on the staff of which company he has been since 1920. He is a chemist by training and by predilection, and has contributed greatly to the technology of dye-stuffs and dyeing, not only in his invigorating lectures and his standard textbook, *Dyeing with Coal Tar Dyestuffs*, but also by virtue of his tireless service to the industry. He has already been vice-president of the Society of Dyers and Colourists, and in 1943 was awarded the Society's Gold Medal, in recognition of exceptional services.

Obituary

MR. ELLIS JONES, of Stretford, who died on March 28, aged 82, had been for many years with J. S. Morris & Son (Oils), Ltd., oil and grease manufacturers, of Cross Lane, Manchester, until his recent retirement.

MR. FRANK BROWNE, F.R.I.C., late of Hong Kong, who died at Ealing, Middlesex, on March 26, aged 81, had been a Fellow of the Royal Institute of Chemistry since 1908.

SIR CLARENCE BARTHOLOMEW, O.B.E., who died at Lower Kingswood, Surrey, on March 31, aged 66, was chairman and managing director of Bryant and May, Ltd., and of the British Match Corporation, Ltd., having entered the match business of Bryant and May in 1901. In 1918-19 he was secretary of the Match Control Board, and in 1940 he became chairman of the administrative committee of the Matches Control.

MR. HAROLD WRIGHT, whose death at his Middlesbrough home, at the age of 77, occurred on March 28, was chief metallur-



Mr.
Harold
Wright.



gist to Dorman, Long & Co., and his passing will be widely felt in the metallurgical world. He had served the Dorman, Long group for 62 years and had been chief metallurgist since 1918. In fitting recognition of his long and outstanding work, the firm endowed the Harold Wright triennial lecture, which is given by "an eminent authority in metallurgical, chemical, or kindred subjects."

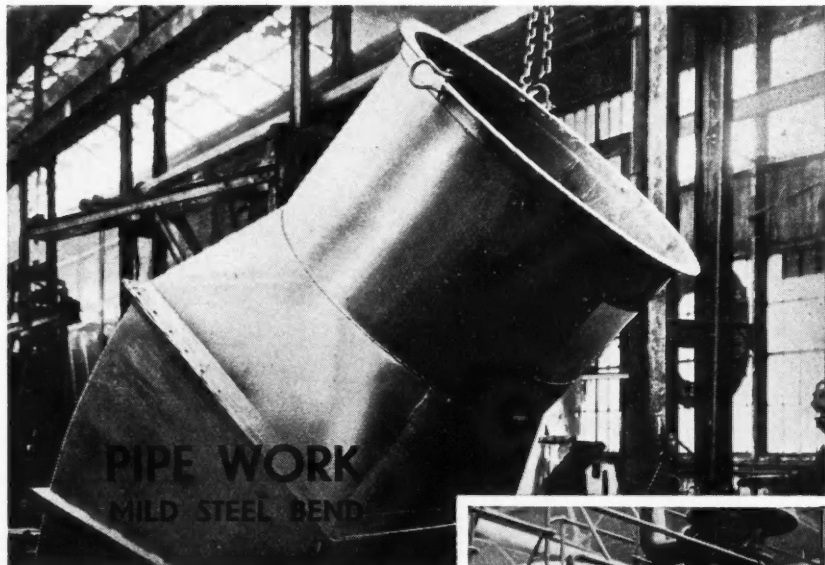
His "valuable contributions made over many years to improve the technique of iron and steel manufacture" was recognised last year by the Iron and Steel Institute, which awarded him its gold medal.

An appointment as chief assistant chemist to the North-Eastern Steel Works opened Mr. Wright's career. Later, as blast-furnace and coke-oven manager to Sir Bernard Samuelson & Co., he took an active part in the supply of molten basic iron to Dorman, Long's Britannia Works when the firm introduced the hot metal process more than 40 years ago.

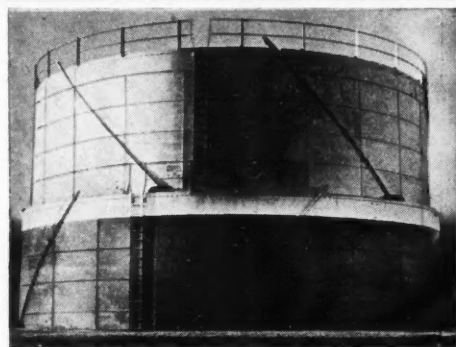
Metallurgical Section

Published the first Saturday in the month

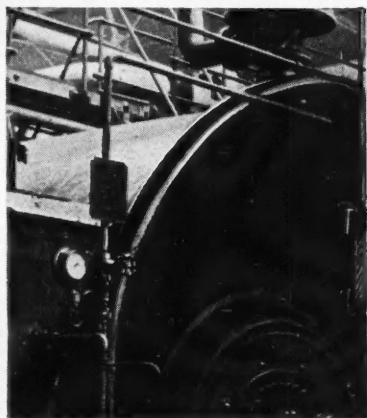
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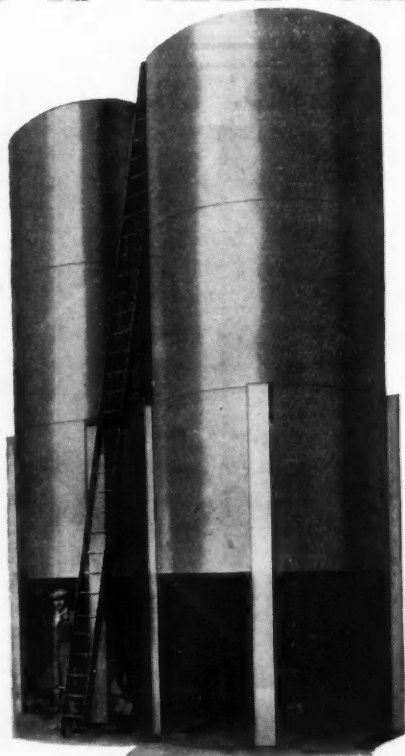


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Metallurgical Section

April 6, 1946

The Refining of Copper Residues—III Variations of the Reverberatory Process

by O. P. EINERL, Dr.Eng., and FREDERIC NEURATH, Ph.D.

(Continued from THE CHEMICAL AGE, March 2, 1946, p. 239)

EQUIPMENT used in a different process was developed and successfully used in the copper refinery of Lissauer & Co., Cologne,¹² as shown in Fig. 11. A melting furnace of the ordinary drum type is mounted on rollers so as to rotate, and is provided with a pouring spout and an outlet opening for the heating gases. Below the melting furnace is a second furnace, the "reaction furnace" arranged also on rollers. This furnace is provided with an opening at the top, through which it is filled and emptied and through which the gases escape during the blowing operation.

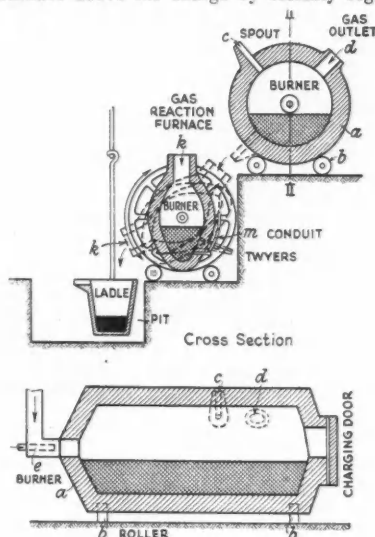
As mentioned before, we have no means of removing even small amounts of lead from a copper alloy containing tin and zinc, without resorting to the relatively expensive procedure of eliminating the tin and zinc from the copper. But by doing so, the valuable tin, oxidised to SnO_2 , will be found in the "mixed oxides." It is therefore imperative to keep high-lead residues separate from high-tin, low-lead residues. Similarly, we have no methods of separating antimony from copper-base alloys, so that it is necessary to segregate lead-base and tin-base white metals (chips, turnings, etc.), which usually contain large amounts of antimony, from otherwise low-antimony material. Such segregation, however, is not always possible and metal refiners have often to deal also with gunmetal borings badly contaminated with white metal.

The Lissauer Plant

The Lissauer process is designed to deal with such material, and the plant is operated as follows. The melting furnace is charged through the door shown on the right in the lower diagram. From time to time the furnace is rotated into the position indicated by dotted lines in the upper diagram, so that a portion of its content flows into the reaction furnace, which is likewise rotated into the position indicated by dotted lines. Both furnaces are thereupon rotated back to the position indicated in full lines.

The temperature of the fluid metal bath in the "reaction furnace" is maintained

by gas, oil, coal dust, or the like, and an oxidising atmosphere is maintained in the furnace above the charge by suitably regu-



Longitudinal Section through the Melting Furnace

Fig. 11. Lissauer rotary furnace and gas reaction furnace for separating and recovering metallic impurities from copper-base material.

lating the combustion of the burner. A short greenish-blue flame is indicative of an oxidising atmosphere, a colourless flame indicates a neutral atmosphere, and a feebly luminous yellow flame denotes a reducing atmosphere.

Reducing gases, such as H_2 , CO , water gas, town gas, producer gas, or coke-oven gas are now introduced through tuyères and a conduit into the molten metal. The gas forced into the bath displaces the zinc, which is in the labile state, or the zinc vapour, from the metal bath. A one-ton

charge will require from 3500 to 5000 cu. ft. of gas according to the Zn content present. The freed zinc vapours burn in the flue to zinc oxide which is in these circumstances practically free from Sn but contains about 10-15 per cent. PbO. During this part of the treatment the furnace atmosphere must be maintained slightly reducing (yellow flame) until the zinc has been removed. The working temperatures lie between 1100° and 1400°C. and depend on the nature and composition of the material to be treated.

As soon as the evolution of zinc slackens off—indicating the end of the reaction—samples are taken from the metal bath and Cu and Pb are quickly estimated. Only small quantities of Zn, well below 0.5 per cent. and mostly not more than 0.2 per cent., will remain; Pb will be reduced considerably; but practically the whole Sn content will be found in the metal. In many cases the metal, freed from its zinc content, will now be suitable for use as an alloy either directly or after blending. The reaction furnace is rotated around its axis into the position indicated in dotted lines on Fig. 11, so that a part or the whole of the furnace contents flow from the opening *k* into the ladle. The mixture of ZnO and PbO, containing mostly about 88 per cent. ZnO, 10-12 per cent. PbO, and about 0.2 per cent. SnO_2 , is collected in a bag filter.

If it is desired to carry on with the refin-

stopped without pouring, and 1 per cent. of copper pyrites is added to the metal bath and melted therein, an operation requiring about 10 minutes. The reaction furnace is then again brought into operation and gas,

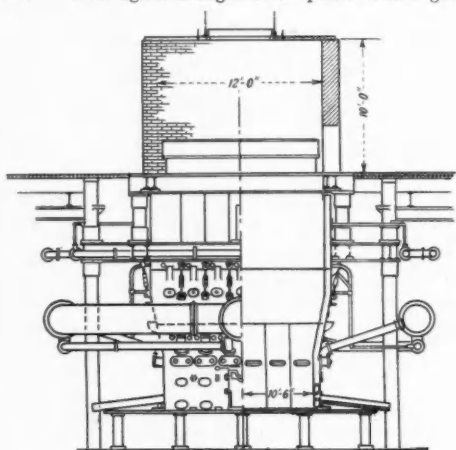


Fig. 13. Section through shaft of copper blast furnace.

preferably preheated gas, of a temperature of about 800°C. under a pressure of 0.7 atm. (10 lb./sq. in.), is again forced into the metal bath at a rate of 40 to 50 cu. ft./minute. At the same time, however, the oil and air supplied to the burner are so regulated that a short flame of greenish-blue colour (no longer yellow) indicates a highly oxidising atmosphere.

Almost immediately a vigorous evolution of SnO_2 takes place, the progress of which can be followed by the intensity of the fume formation in the same way as in the case of zinc. After the evolution of fume has slackened off, samples are taken and eventually a copper freed from Zn, Pb, and Sn results, with about the

same composition as that obtainable in a reverberatory furnace. But, unlike in the reverberatory process, the oxides trapped

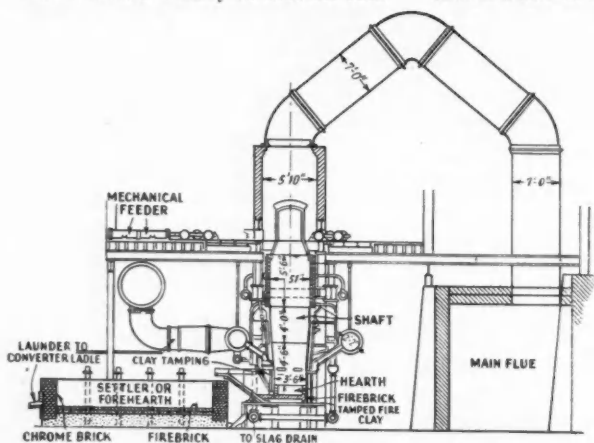


Fig. 12. Lay-out of a copper blast furnace, 4-ton capacity.

ing in order to remove tin, or amounts of antimony which would be harmful to the use of the metal, the reaction furnace is

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in the filter from the oxidation period constitute a highly concentrated tin oxide with about 70-75 per cent. SnO_2 , 15-20 per cent. PbO , 6-8 per cent. ZnO , and 0.5 per cent. CuO .

The advantage of the reaction furnace therefore is that not only can valuable volatile metal be separated from the copper base residues in what amounts to a single operation—thus being practically completely recovered—but also that only small amounts of slag (about 3 per cent. of the metal treated) are obtained, having a metal content of about 50 per cent.

Blast Furnaces

The smelting of copper residues in copper blast furnaces follows the same lines as those developed for the smelting of sulphide copper ores; in fact, they are usually added to roasted pyrites and it is often advisable to have the copper residues roasted as well. The impurities to be expected are in fact very similar. Roasted

impure cement copper, roasted residues from copper sulphate production, roasted cyanide waste from electroplaters, etc., will contain oxides, sulphates, and undecomposed sulphides of copper and iron, and to a lesser degree of zinc, lead, and manganese.

The blast-furnace process aims at producing copper matte, i.e., a sulphide which has been prepared artificially by fusion. A copper matte consists of a mixture of cuprous sulphide, Cu_2S , and ferrous sulphide, FeS , in any proportion.

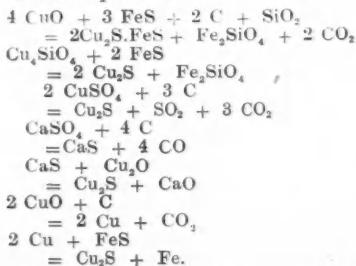
The affinity of copper for sulphur is very strong as compared with that of other metals and much stronger than the affinity of copper for oxygen. The smelting to a matte of copper residues high in SiO_2 (foundry sand, etc.) and rich in metallic impurities, together with iron pyrites and roasted sulphide copper ores, is just one step in bringing the copper content to a higher concentration by removing a certain portion of the accompanying impurities.

In the reduction fusion Cu , Fe , and S



Fig. 14. Charging a modern converter.

form a matte, while the gangue with the necessary fluxes forms the slag consisting of SiO_2 , FeO , CaO , some Al_2O_3 , and other bases. From the addition of excess coke, to act as a reducing agent and to furnish the heat for the reduction, the following reactions will take place²³:



There is little danger of copper being oxidised as long as there is enough FeS

present to sulphurise any metallic copper or copper silicate that may have entered the blast furnace or been formed in the downward passage of the charge.

The main requirements that the silicate slag has to fulfil are: (1) it must form at a low temperature; (2) it must require little superheating to be fluid; (3) the specific gravity must not be too high (to allow a satisfactory settling and separation of matte); and (4) it must be cheap, i.e., not much flux required.

Characteristics of Slags

As a general rule it can be said that the formation temperature of the slag decreases as the "silicate degree" rises, but also, with a rising "silicate degree," the fluidity of the slag decreases. "Silicate degree" is the ratio of oxygen atoms combined with Si to the oxygen atoms combined with the base metals in the silicate. For example, the "silicate degree" of CaSiO_3 or $\text{CaO} \cdot \text{SiO}_2$ is 2 to 1 and the slag is a disilicate. The "silicate degree" of Ca_2SiO_4 or $2 \text{CaO} \cdot \text{SiO}_2$ is 2 to 2 and therefore equal to "1" and the slag is a monosilicate. Monosilicate forms at a higher temperature but is more fluid than a disilicate, while the sesquisilicate lies between the two.

Basic or monosilicate slags are thin and fluid, but more corrosive to furnace refractories than more "acid" slags, such as sesqui- and di-silicate slags. As the copper slags are usually discharged from the furnace at 1100°-1300°C., the slag must be liquid and free-running at this temperature.

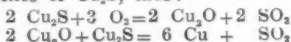
Most copper blast furnaces are water-cooled throughout, as almost every furnace-man works for some pyritic effect in order to oxidise part of the sulphur and iron in the charge. This is done by forcing a large volume of air into the furnace, and the result is that the top becomes hotter than a shaft of brick could stand. Water jackets are of soft steel and not of cast iron.

The "settler" or forehearth of the blast furnace serves not only as a separator of matte and slag, but also as a holder for matte. The matte is tapped at intervals into ladles and conveyed to the converter. The settler consists of a boiler-iron shell lined with refractory material and has usually one slag overflow and two matte taps. The hearth of the furnace is erected on ribbed cast-iron plates supported by iron posts and jack screws. The masonry of the hearth is encased by heavy ribbed cast-iron plates firmly bolted together.

Conversion of Copper Matte

The operation of treating the artificial sulphide "matte" to produce metallic copper is called converting. This is done by oxidising iron and sulphur in a converter by means of blowing air through the molten

matte to which siliceous material has been added. The following reactions occur²⁴:
 $2 \text{FeS} + 3 \text{O}_2 = 2 \text{FeO} + 2 \text{SO}_2 + 224,000 \text{ cal.}$
 $x \text{FeO} + y \text{SiO}_2 = x(\text{FeO}) \cdot y(\text{SiO}_2) [\text{slag}].$
 As soon as all the iron is oxidised, Cu_2S begins to oxidise and the cuprous oxide formed reacts immediately with further quantities of Cu_2S , thus:



The early copper converters copied the Bessemer steel converter with acid lining (silica or siliceous ore). The modern converter, shown in Fig. 14 in process of being charged, is a basic-lined type, which gives better resistance to the action of the basic FeO . A description of modern copper smelting practice using converters has been given by Macleod in *Mining and Metallurgy*.²⁵

During the blowing period the tuyères must be punched almost continually. The appearance of the flame and of metallic copper on an inserted steel rod determines when the blow has been completed. The copper produced in the converter will contain between 98 and 99 per cent. Cu, and is called blister copper. The impurities still present will be Ni, Co, Fe, Sn, Sb, Zn, and Pb. Furthermore, if the blowing period was too short, the copper will contain a small amount of sulphur; if blown too long, it will contain dissolved Cu_2O . The blister copper is transferred into a casting furnace and from this furnace finally cast into cakes for shipment or anodes for further electrolytic refining.

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- ³ HULL, SILLEMAN & PALMER: Effect of Sb on 70/30 brass. *Trans. Amer. Inst. Min. Met. Eng.*, 1943, p. 127.
- ⁴ *Chem. Age*, 1943, 48, 267, 371.
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- ⁹ B.P. 509,112/1938.
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- ¹¹ *Metal Ind.*, 1943, 162.
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- ¹⁴ B.P. 562,407/1944.
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- ²² B.P. 366,628/1932.
- ²³ HOFMAN & HAYWARD, *Metallurgy of Copper* (McGraw-Hill, New York, 1924, p. 110).
- ²⁴ NEWTON & WILSON, *Metallurgy of Copper* (Wiley & Sons, New York, 1942, p. 171).
- ²⁵ Abstracted in *Metal Ind.*, 1943, 39.

ERRATA

- p. 142, February 2. Caption of Fig. 5 should be, "Section through 5-ton grate-fired reverberatory furnace."
 p. 237, March 2. Caption of Fig. 9: for "globules of Cu_2S ," read "globules of Cu_2O ."

Corrosion of Metals

New Phosphating Methods of Protection

by W. G. CASS

SEVERAL interesting and important developments have taken place in recent years in the well known process of phosphating metal surfaces to withstand corrosion. These include a very considerable shortening of the time required; an extension of the method to other metals than iron or steel; a lowering of the temperature necessary from nearly boiling point to room temperature; the use of phosphated black plate as a substitute for tinplate in food canning; and the use of phosphating as an aid to lubrication in many metal working operations, such as deep drawing, wire manufacture, etc.

The last-mentioned is not, indeed, particularly recent, so far as the patent literature is concerned, for as early as 1921, J. H. Gravell, in U.S. Pat. No. 1,428,087, proposed a thin coating of iron phosphate on steel prior to rolling, drawing, etc., in order to reduce risk of corrosion, and although lubrication was not specifically mentioned, it was clear that anything which reduced corrosion or increased adhesion of the lubricant used—as phosphating was then known to do—would be a powerful aid to lubrication. Some years later, about 1935, F. Singer in Germany (Ger. Pat. 673,405) proposed the application of the ordinary phosphating methods for coating and lubricating metals to be drawn, rolled, etc.; and in 1937, in a somewhat different but related sphere, it was suggested that piston rings for automobile engines should be phosphated in order to prevent seizing or scuffing. In this connection, too, reference may be made to the report issued last year by the Automobile Research Committee of the Institution of Automobile Engineers, on the use of phosphating and other methods to prevent scuffing of gears.

Recent German Work

A considerable amount of work was done in Germany during 1940-44 and earlier, by the Metallgesellschaft Akt. Ges, of Frankfurt. The earlier work is covered by English, German and other patents, and includes special treatment of iron, steel and other metals with solutions of phosphates or oxalates prior to drawing and shaping. Later work by the research staff of the same company has recently been described in the German technical press (1944), but does not add much to what is already known in this country. Various advantages are claimed, such as reduction in drawing load, increased number of operations without risk of seizing, improved appearance, and the possi-

bility of using low-oil emulsions in place of the highly viscous preparations hitherto employed. Use of the right type of lubricant is, of course, important, and its adsorption by the metal surface and adhesion thereto are greatly increased by phosphating.

Great progress has been made recently in reducing the time necessary for phosphating. This has been achieved largely by adding accelerating agents to the phosphating solution or bath, such as a nitrate, nitrite or sulphite. These act as oxidisers and removers of the hydrogen set free in the phosphating process. A so-called hydrogen blanket is formed at the surface of the metal and if not removed would slow down and soon stop the process. The latest methods of acceleration include also the adoption of spraying under pressure, and the use of resilient rollers arranged in series. By these various methods the time required for operating the process has been reduced from about an hour, necessary with the earlier methods, to a matter of seconds, or at the most one minute. It is thus possible also to adopt mass-production or belt-conveyor methods and use the process on a large scale.

Low-Temperature Methods

A further new and comparatively recent improvement is the lowering of the temperature required. Usually this has been near the boiling point of the phosphating solution, that is to say in the neighbourhood of 98°C., although with certain types of bath it may be much lower. The still lower temperature claimed in some of the patent specifications, like the speedier working, is partly due to spraying under pressure, partly to the warming effect of the pre-treatment and cleaning of the metal, but largely and chiefly to the addition of special materials to the bath, whereby the proportion or concentration of certain elements and the acidity of the solution are controlled within very exact limits. Thus, in a recent account of what is called the cold Boderising (phosphating) process in Germany, the following basic factors in cold phosphating are described in detail: pH value (acidity), concentration of phosphate and of metal, choice of suitable accelerator and auxiliary accelerator, and the concentration thereof in the solution.

This combination of reduced time and reduced temperature for phosphating has proved particularly valuable in another important development—the use of phosphated sheet iron, or black plate, in place of tin-

plate for food containers or cans. Several patents of the Pyrene Co., Ltd., in this country and of the Parker Rustproofing Co. in the U.S.A. cover the phosphating of iron sheet or strip, by a more or less continuous method, to be fabricated into cans. See, for example, Br. Pats. Nos. 554,348, 554,734, 557,846, and 561,670. It is true that, in the U.S.A., considerable attention has been given to the possibility of economising tin consumption by using electrolytic tinplate instead of the usual hot-dip plate, as the former requires much less tin than the hot-dip tinplate. But numerous tests have been made also with Bonderised (phosphated) black plate, especially for the ends of the containers. Tinplate of one sort or another is still preferred apparently in the U.S.A. for the bodies of the containers, as a general rule. In Germany, however, whether the tin shortage has been much more acute and dates much further back,

Bonderised black plate has been extensively used for food containers for many years, since 1937, if not earlier. The need was, of course, still greater during the last war, and black plate was still more extensively used. Improved methods for the mass production of food containers were developed.

In all cases the Bonderised plate requires a finish of enamel or lacquer, and the adhesion of this to the phosphated metal surface is much better and stronger than with other kinds of preliminary surface treatment. As a general rule it may be said that phosphated black plate is a good substitute for tinplate, and may be even better in some cases; but owing to the great variety of different foods now put into cans, no hard and fast rule can be laid down. Research in this field is being continued, and some of it was reported by Adam and Dickinson, in their paper read at the autumn meeting of the Iron and Steel Institute last year.

Anodising Magnesium Alloys

Some Post-War Applications

COMMERCIAL aircraft of the future are expected to be made largely of magnesium alloy because of its exceptional strength/weight ratio, its rigidity, the damping effect it has on vibration, and because the tremendous expansion of magnesium production for war needs will make unprecedented quantities of this light metal available at an economic price.

With increase of size of air transports, however, their production cost goes up, and each aircraft involves a larger capital investment which must be protected, so that it is necessary to extend the service life. The problem with magnesium alloys has been to make them sufficiently resistant to corrosion to preserve their strength for a satisfactory life expectancy. Good resistance to corrosion is particularly valuable in the case of skin sheets for covering the fuselage and the wing and tail structure; some of these sheets are only 1/32 in. thick or less, and even a little corrosion would have a relatively large weakening effect.

Some aircraft companies have found a partial solution of the problem in the application of oxide, hydroxide, carbonate, and dichromate coatings. These are applied variously by heating, by heating under pressure in an autoclave, or by electro-deposition, the last method being the most practical for quantity production. All the coatings provide fair corrosion resistance, but the sealed chrome pickle or acid dichromate treatment is most effective in this respect, while oxide, hydroxide, and carbonate coatings are much the most resistant to mechanical abrasion.

Interest is being shown in a method of

anodising developed as a result of experiments using the electro-chemical process and various electrolytes. The process is notably simple and gives good results, and the protection afforded to magnesium alloys against not only corrosion, but also abrasion and scratching, is said to be superior to that of any other known practical treatment for the purpose. The coating produced is harder than the metal, and tests have shown that it would protect the alloys even during forming operations as well as from scratching during assembly of parts. These considerations make it suitable for application in the manufacture of furniture, toys, etc., and electric appliances. Castings given only the anodic treatment look almost ornamental and all that is needed to preserve the beauty is a wax coating. It is possible, however, to produce highly-coloured castings if desired.

An alkaline electrolyte consisting primarily of caustic soda is used in the process, which may be operated on either alternating or direct current. No noticeable change in effectiveness of the electrolyte has occurred during four months of use. A series of four tanks at one plant are used for an unbuffered alkaline cleanser, a hot-water rinse, the anodising electrolyte, and a final rinse in a dilute chromic acid solution. All magnesium alloys in sheet and extruded forms and forged parts are being anodised simultaneously, but castings are treated separately at a slightly lower temperature.

Parts are racked for the process by means of H-type clamps made of magnesium, which have been found convenient and durable. Use of a hot-air dryer after the chromic acid rinse is recommended. Immediately

after drying, the alloys are dip-primed completely to seal the anodic finish and help prevent corrosive media from coming into contact with the magnesium while parts are being assembled. This dip-priming would be omitted and a hard wax coating applied in the case of parts intended for household or other articles where an attractive finish is desired and the wax will provide sufficient protection.

Heat tests of anodised alloys showed that temperatures up to 700° F. had very little effect on the corrosion resistance of any of the finishes. An important point in aircraft manufacture is that explosive rivets filled with magnesium metallic powder do not blow off the anodic finish adjacent to the rivets and expose the underlying metal to corrosion by salt spray.

Metallurgy of Antimony

Beneficiation of Low-Grade Ores

A NOTE in a recent issue of the *South African Mining and Engineering Journal* summarises the processes employed in the beneficiation of antimony ores, quoting extensively from Wang and Riddell's new volume "Reduction and Refining of Non-Ferrous Metals."

Where the consideration of freight to distant smelting centres is of importance, it is stated, or where the ore contains valuable constituents apart from antimony, the beneficiation of low-grade antimonial ores by gravity concentration, air concentration, and flotation is either being planned or actually in effect in all producing regions.

For an ore containing an appreciable amount of arsenopyrite, it is sometimes advisable to use differential flotation to get rid of the arsenopyrite, which otherwise would contaminate the product from the pyrometallurgical treatment of such ore. Of all the concentration methods, flotation appears to be by far the most satisfactory. Hydrometallurgical or electrolytic methods of extracting antimony are uneconomical, and only under exceptional high prices and in special circumstances may their adoption be recommended.

It is to be emphasised that whatever smelting method is followed an antimony plant must have a particularly good fume and condensing system. With ordinary settling devices—such as flues with reduction or expansion of cross sections, Freudenberg plates or Roesing wires—only dust larger than 10 microns can be deposited, hence antimony fumes, in which the particles range from 0.3 to 1.0 micron, and settle very slowly even in still air, cannot be effectively deposited. The usual cyclone dust catcher acts ineffectively with antimony fumes; even the multicyclone cannot settle particles smaller than 5 microns. Filtration of fumes by

means of bag filters has been adopted at many antimony works. The Cottrell precipitator has been adopted at a few places and has proved its worth as a secondary cleaner for the oxide fumes. Scrubbing or washing the fumes, involving as it does the intimate mingling of the fumes through the action of sprays or jets of water, is not thoroughly effective in precipitating the oxide. However, the recently-developed Peabody process, an improvement of the old-time scrubber, may be applicable to the condensation of antimony fumes.

Of the 112 known minerals containing antimony, the only really important ore is stibnite— Sb_2S_3 . For various grades of ore, however, the following methods are generally adopted:

- (1) Sulphide ore containing ± 20 (say, 15 to 25) per cent. Sb, the volatilisation method.
- (2) Sulphide ore containing ± 35 (say, 25 to 45) per cent. Sb, the blast-furnace method.
- (3) Sulphide ore containing ± 50 (say, 45 to 60) per cent. Sb, the liquation method, and the English precipitation method.
- (4) Oxide ore containing ± 30 (say, 25 to 40) per cent. Sb, the blast-furnace method.
- (5) Oxide ore containing ± 50 per cent. Sb, the direct-reduction method.
- (6) Mixtures of sulphide and oxide ore, the blast-furnace method.

Dead roasting of sulphide ore to the stable tetroxide, as a process for the treatment of rich ore, is now obsolete.

CHROME ORE PRICES

The following prices for chrome ore apply as from April 1 (prices quoted are per ton): *Refractory grades*—Rhodesian Imperial grade, £10 15s.; Transvaal, first grade, £8 17s. 6d. *Metallurgical grades*—Rhodesian lumpy metallurgical, £10 17s. 6d., Rhodesian washed concentrates, £10 17s. 6d., Baluchistan, £10 15s. *Chemical grades*—Rhodesian Dyke chemical, £10 17s. 6d., Transvaal chemical concentrates, £11, Baluchistan, £10 15s.

TIN EXPORT PRICES

The Ministry of Supply announces that as from April 1, the price of tin sold by the directorate of Non-Ferrous Metals for export from the U.K. is £357 per ton, f.o.b. U.K. port for common tin in ingots (of 99 per cent. minimum purity, but less than 99.75 per cent. tin content) in lots of one ton and upwards, with the usual extras for all other grades, shapes and sizes.

Steel production in South Africa amounted to 518,230 tons in 1945, as compared with 466,216 tons in the previous year, and 326,154 tons in 1942.

Light Metal Manufacturers

New Association Formed

A GROUP of Light Metal Manufacturers, which originated in war-time with the pooling of technical information in the national interest, have recently collaborated to form a development organisation known as "Alar." Through this organisation the co-operative efforts of the technical staff of each of these manufacturers is now being applied to the peace-time requirements of industry.

The purpose of Alar is, firstly, to ensure that the present high standard of secondary aluminium alloys is maintained, and, secondly, to promote their use by bringing about a wider appreciation of their properties. The research programme, which includes the development of new alloys, is being carried out in close collaboration with other technical and research associations. An important feature is the issuing of publications bringing to the attention of present and potential users up-to-date information on the properties and applications of aluminium alloys. A technical advisory service with considerable scientific resources is available without charge to all users of aluminium casting alloys.

Further particulars, including details of Alar's inspection service, which is run on similar lines to that maintained by the Aeronautical Inspection Department during the War, may be obtained from the Secretary, Alar, Ltd., 6 Old Jewry, London, E.C.2 (ROYal 1291).

Malayan Tin Industry

Estimated Output for Four Years

AN amplified summary of the report on the Malayan tin industry by Mr. A. D. Storke, Adviser to the Secretary of State for the Colonies for this purpose, says that the estimated output of recoverable tin metal from all sources in Malaya is 12,300 tons for 1946, 46,150 tons for 1947, 72,800 tons for 1948, and 73,500 tons for 1949. These estimates are subject to the availability of native labour and European staff, transport, mining equipment, manufacturing facilities, electric power, and coal. About 70 per cent. of the former local labour forces is available and, with a few exceptions, has been put to work by the tin mining companies.

The principal power stations are in operation and, subject to repairs, should be able to meet an increasing demand. The chief bottleneck in respect of power supply is coal. Although plans have been formulated for increased production, it will be necessary to import coal in 1946 and 1947 to meet Malayan requirements.

DR. C. H. DESCH, F.R.S., will be inducted as president of the Iron and Steel Institute at the annual general meeting on May 1.

MR. A. G. CHARLES, who has been with the Directorate of Non-Ferrous Metals since the beginning of the war, has been appointed Director in succession to Mr. R. D. Burn.

MR. C. F. BATSTONE, formerly Midland branch manager of the British Aluminium Co., Ltd., has been appointed principal assistant sales manager. MR. C. G. POUNTNEY has been appointed Midland branch manager.

MR. K. G. LAMPSON, who has been Deputy Iron and Steel Controller since January, 1943, has been released by the Minister of Supply in order to return to industry. He will continue in an advisory capacity to the Controller.

MR. G. H. LATHAM, who has been appointed president-elect of the British Iron and Steel Federation to take office in 1947 in succession to Mr. Ellis Hunter, is chairman and managing director of Whitehead Iron and Steel Co.

MR. J. D. A. HOWIE has taken up his duties as acting superintendent of the Scottish Laboratory of the British Cast Iron Research Association. He has held posts as metallurgist with Mirreles, Watson & Co., Ltd., Philips Blackburn Works, Ltd., and other companies.

MR. A. E. MCRAY SMITH is relinquishing his position with the development and Research Department of the Mond Nickel Co., Ltd., to take charge of the foundry consulting activities of the Keighley Laboratories, Ltd., consulting metallurgists and foundry specialists, as from May 1.

PROFESSOR J. NEILL GREENWOOD, D.Sc., who has occupied the Chair of Metallurgy at Melbourne University since 1924, has accepted the invitation of the Council of the University to occupy the new Chair of Metallurgical Research, establishment of which was made possible by contributions from the Broken Hill group of companies.

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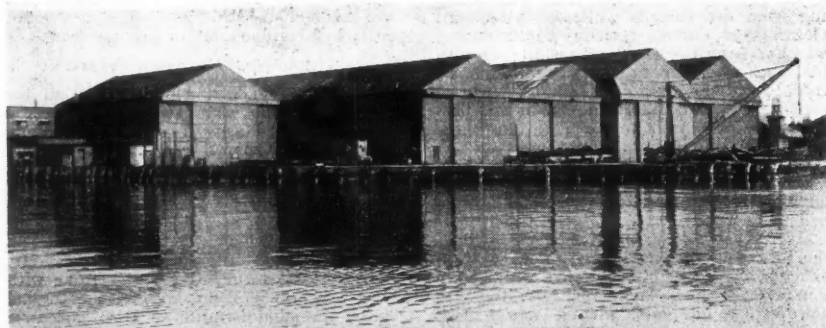
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Manufacturing Laboratory Chemicals

New B.D.H. Plant at Poole

IT has recently been announced that the British Power Boat Company's factory at Poole, Dorset, has been allocated by the Board of Trade to the British Drug Houses, Ltd. During the war this factory was used

has been practically destroyed, and there is at the present time a serious shortage throughout the world of pure chemicals for laboratory and research use. Research institutions, universities, technical schools,



The new B.D.H. plant at Poole Harbour, here seen in a photograph taken specially for *The Chemical Age*, occupies the buildings lately used by the British Power Boat Company. It will be noted that they still bear their war-time coating of camouflage.

for the construction of light coastal craft, but it is now to be adapted by the B.D.H. to the manufacture of chemicals for laboratory and research use in the home and export markets. We are informed that the B.D.H. propose to transfer the whole of their laboratory chemical section to Poole to operate as a separate unit, and it is expected that within a relatively short time their present production of pure chemicals for scientific purposes will be very greatly increased. Plans are being made for the transfer of a number of key personnel on the B.D.H. staff from London to Poole, but local labour will be largely employed.

The German laboratory chemical industry

and industrial concerns throughout Europe and elsewhere are anxiously waiting for supplies. In Britain itself, chemicals essential for the application of scientific control in industrial development are not readily available in adequate quantities. It is imperative that there should be an immediate expansion in the production of laboratory chemicals, and that Britain should build on a sound foundation an industry in which considerable scientific prestige has already been won, thanks largely to the development of the B.D.H. since its foundation in 1908, with the union of a number of old-established firms, and especially since the 1914-18 war.

NATIONALISATION AND INFLATION

"Our leaders in commerce and industry have always considered the creation of reserves, adequate to meet every reasonable contingency, to be of the very first importance. Their balance sheets are constructed with caution, and understatement is preferred to overstatement. Assets are quoted 'at cost or under,' and in the interests of both shareholders and workers, the distribution of dividends has been regarded as of less importance than provision for continuity and progress. If, however, as is now suggested, the State is to purchase on a

basis of dividends distributed, there may be a change in this wise attitude; companies will be tempted to distribute more and to leave the future to take care of itself. Any such change must be inflationary in its nature and must weaken the confidence of the public. Conservative finance is the very basis of British credit."—From the annual report of Sir Ernest Benn, chief Proprietor of *THE CHEMICAL AGE*, to the members of the United Kingdom Temperance and General Provident Institution.

LETTER TO THE EDITOR

Insecticides

SIR,—So once more Mr. F. N. Pickett trots into the tilt-yard mounted on his favourite hobby-horse, a fly-blowa fleece thrown round his shoulders, and a wilted hop-bone stuck in his hair! His somewhat overworked, overfamiliar, and nicotinic steed stands quivering and bleeding from the nostrils while his attendant, Colin Clout, stands panting and retching, whether from the effect of keeping up with his master's quixotic adventurousness or from over-indulgence in arsenic eating we cannot be sure. Unfortunately, in this present jousting, your unfortunate reviewer has become unwittingly implicated in the skull-cracking as a principal victim and would escape if he could; since he cannot, he will endeavour to give as good as has had to be taken.

Mr. Pickett has entered the lists in little short of an emotional frenzy, and so it is difficult to discern his grievance with precision with so much laying-on. Mr. Pickett, however, would claim that it was I who flung down the gauntlet with an "attack" on DDT, and re-reading of the appropriate passage in my review shows this to be a preposterous suggestion. I claim that the passage referred to was objective and as fair a representation of progress during 1945 in this particular field as could be made in the space allowable, and that compression has not produced distortion. Moreover, it may be of interest for Mr. Pickett to know that I have not the remotest connection with manufacturers of DDT or of preparations thereof, and that the reason for my offending remarks appearing at the season in question is not, as he suggests, at the behest of some wicked, lying sales manager, but simply because it happens to be the time of the year when, Sir, your Annual Reviews normally appear.

Inconsistent?

Mr. Pickett is not impressed (*sic*) by the research of Levis and Richards which was reported, nor with the work of Messrs. I.C.I., Ltd., so ably summarised by Slade. Worst of all, Sir, he is unimpressed by your reviewer's competency and objectivity. (What! Does the scoundrel want your reviewer sacked with ignominy, Sir?) It does, nevertheless, seem a little inconsistent to reject these various works out of hand and yet expect your readers to swallow deductions drawn by Mr. Pickett from his own—experimentations. Because Mr. Pickett states his conclusions and beliefs in such stentorian tones that they reverberate between cover and cover, it does not necessarily make them reliable, true or acceptable.

Mr. Pickett objects to Dr. Slade's claims

(presumably because he didn't like 'em) and makes the precious (if not precocious) suggestion that they "may have arisen as a result of but few experiments." I am personally unacquainted with Dr. Slade and have no connection with Messrs. I.C.I., Ltd., yet it seems to me that in the light of what is generally known of the technical, material and financial resources of this company, to say nothing of the great probability that in their biological work full use was made of statistical method, Mr. Pickett's remarks are ingenious to say the least.

Hoist With His Own Petard

It seems that Mr. Pickett falls all too readily into the very fault he criticises in others when he asks your readers, Sir, to accept his statements regarding the toxicity of DDT on "but few experiments," or, at any rate, on "but few" subjects. Mr. Pickett has had DDT blown into his eyes and worked into cuts; he has immersed his hands into solutions of DDT in organic solvents; he has swallowed it. In fact, Mr. Pickett seems to have tried everything with DDT to accomplish his self-destruction except the administration of DDT parenterally by means of a horticultural syringe! (It seems very necessary to hasten to add that this is not, of course, a serious suggestion.) In case an unbiased observer might claim that the results of Mr. Pickett's misuse of himself is not statistically significant, that is, that the (so far, happy) result is not impossible though highly improbable, he brings in support the unwitting aid of the old brown cow, thus transferring his argument from the human to the veterinary field and widening the issue; and, if one may enter the piscatorial field, drawing another red herring across the trail. Your reviewer does not wish to be misunderstood. At the risk of a reiterated accusation of "finessing and manoeuvring for position," he is not at this moment stating that Mr. Pickett's conclusions are right or wrong. He merely challenges the wisdom of arguing from the particular to the general and merely indicates his belief that Mr. Pickett's conclusions are supported by "but slender evidence." One feels that throughout his letter Mr. Pickett is indulging in a series of gentle hoists with his own petard.

As to Mr. Pickett's experiments regarding the relative efficacies of DDT and Gammaxene, which he states he has conducted during the past 12 months, I herewith challenge him to publish his work. In the light of his criticism of the Ministry of Agriculture for withholding information, he can hardly be so ungracious as not to accept this challenge, and I am sure you, Sir, would offer him the hospitality of your columns.

Regarding the Ministry of Agriculture, could it have been that they declined to make available to Mr. Pickett uncompleted

experimental work? Or, alternatively, did they decline to favour him with the sight of their work prior to publication? Either of these grounds would seem reasonable to your reviewer. In any case I suspect that the work to which Mr. Pickett refers is now published, and I refer him to *Nature* (1946, 157, 286); though I fear he might find that the "talk may be high falutin" to a simple man, as he complains; might still find it difficult "to determine what the truth is." Those whose work is reported might reply that their reports are not directed to the "simple man" nor was my review, Sir.

Finally, Sir, Mr. Pickett's remarks have caused me profound offence. The very

least he can do by way of atonement is to send me a case of his activated-DDT-protected and unblemished pippins in due season. If he fails to respond thus generously my consolation will be that the readers of your *Journal* will—if, for once, I may be permitted to abandon the "staid and formal language" which Mr. Pickett attributes to me—have enjoyed one of the best laughs to be found between its pages during the past decade.—I am, Sir,

Your humbled but expectant Reviewer,

G. COLMAN GREEN.

Hull.

March 30.

General News

The centenary of The Chemical Society is to be marked by celebrations in July, 1947.

The chemical, dyestuff and drug industries are to be included in a partial census of production in this country for 1946.

A report has been submitted to the Government concerning the discovery of potash near Whitby during oil-boring work.

The list of prices of non-ferrous scrap metals issued by the Ministry of Supply for the three months to March 31 now applies until June 30.

The London office of the Leeds and Bradford Boiler Co., Ltd., has been moved from its war-time address to 44-45 Tower Hill, London, E.C.3 (tel., ROYal 1461).

The Minister of Food announces that there will be no change in the existing prices of unrefined oils and fats and technical animal fats allocated to primary wholesalers and large trade users during the five weeks ending May 5, 1946.

The British Aluminium Company has acquired the Latchford Locks (Warrington) Refinery and Powder Works and is now able to offer secondary aluminium alloys for incorporation in wrought materials and for casting and other purposes.

Scottish Oils, Ltd., are understood to be ready to begin large-scale surface extraction in the Westwood area near West Calder. Although the deposits to be worked are not excessive, they will provide supplies for the Westwood retorts over a period of some years.

Air-mail correspondence for all destinations in South America, Central America and the West Indies is now accepted for transmission by British South American Airways' twice-weekly service on the district route to South America at the uniform rate of 1s. 6d. per $\frac{1}{2}$ oz. for letters and 9d. for postcards.

From Week to Week

The Scottish Agricultural Organisation Society and the Scottish Seaweed Research Association have approved the establishment of a new seaweed processing factory at Lochport, North Uist, on the site of the former Old Kilp station of the Glasgow Chemical Co.

The Road Research Board of the D.S.I.R. has been reconstituted to meet the recommendations made in 1939 by the Alness Committee of the Prevention of Road Accidents. Sir Frank Smith, F.R.S., is chairman of the reconstituted Board; Mr. J. Davidson Pratt, C.B.E., represents the chemists and tar distillers, and Professor J. D. Bernal, F.R.S., the physicists.

Widespread chaos in many sections of industry was predicted by Mr. C. Owen Morley, President of the National Paint Federation, at a conference in London on Tuesday, if the Government does not obtain a greater supply of raw materials for the paint trade. The present disastrous scarcity of paint was ascribed in particular to shortages of linseed oil, lithopone, and titanium. Mr. Morley thought this country was not receiving its fair share of the Argentine linseed crop.

A survey of the development, ramifications and interests of I.C.I., Ltd., was given to Glasgow Publicity Club last week by Mr. Gordon Long, of I.C.I. The company was based, he pointed out, on earlier groups of basic industries in Britain. The eleven main divisions were the result of recognition that the chemical industries, at the basis of all their operations, were the handmaidens of all other industries. Between 1927 and 1942, no less than £62,000,000 was spent on research by I.C.I., while a sum of £48,000 per annum was recently set aside to provide research facilities in Universities in Britain. There were 900 full-time research "backroom boys" at work for the company.

The Iron and Steel Institute announces that by arrangement with Sheffield University the first Hatfield Memorial Lecture will be delivered by Dr. George B. Waterhouse, Professor Emeritus of Massachusetts Institute of Technology, at the Institution of Civil Engineers, Great George Street, London, S.W.1, on May 1, at 8.30 p.m.

More than 70 chemists attended the inaugural meeting of Slough branch of the British Association of Chemists on March 30 when Dr. A. E. Dunstan, chief chemist of the Anglo-Iranian Oil Co., Ltd., lectured on "Petroleum—A source of synthetic materials" and a film, "Bouncing Molecules," was shown. The chairman, Mr. N. Sheldon, announced a series of monthly technical meetings.

The period for filing patent applications enjoying Convention priority in France has been extended for British nationals until August 28, 1946, in consequence of a special Anglo-French agreement of last year. The moratorium for the belated payment of renewal fees has been extended for all countries up to December 31, 1946. It can be assumed that U.S. nationals will have an opportunity to claim belated convention priority now that the Boykin Bill has become law.

Arising out of the peat survey which is to be made by the Scottish Fuel Economy Committee, the "Lovat Plan" for developing the Crown peat mosses in Caithness, devised by the late Lord Lovat in 1913, may be revived. In an article in the *Scotsman*, Mr. Donald Mackay recommends the utilisation of the mosses near the station of Scotscaid, on the Wick and Thurso railway, as a means of combating the coal shortage. Ample local labour is available, including 4000 Poles still billeted in the county.

Courtaulds, Ltd., have given £60,000 to Leeds University for the establishment of a rayon division in the University's department of textile industries, thus increasing the facilities for research in rayon technology. It is proposed to expend the money in erecting a new building equipped with modern machinery. The sum involved is the second instalment of the £500,000 which Courtaulds decided to set aside for the purpose of extending technological facilities at educational institutions; it follows a gift of £100,000 made last year to the Imperial College for chemical engineering.

Foreign News

Denmark imported last year 13,773 tons of pig-iron, compared with 61,692 tons in 1939. Imports of raw phosphates essential to the country's intensive agriculture totalled 68,779 tons against 230,000 before the war.

Steel production in the British zone of Germany totalled 137,000 tons in January, 63,000 tons less than the output allowed by the military government.

The Thuringian potassium works supplied about 160,000 tons of fertiliser in the first quarter of this year to users in the Russian zone of Germany.

Monsanto (Canada), Ltd., Montreal subsidiary of Monsanto Chemical Co., of St. Louis, U.S.A., is building a polystyrene plant in Montreal.

A Canadian company is manufacturing butyl crotonate (from synthetic butanol and crotonic acid) in research quantities in a small pilot plant.

The Beryllium Corporation, Reading, Pa., U.S.A., announces that the price of beryllium contained in beryllium copper alloy has been reduced to \$14.75 per lb. from the previously prevailing price of \$17.

A Czech mining commission has recommended the resumption of mining of zinc ore near Rymarov, in Moravia, with a zinc content of 48.7 per cent. Plans are also in hand to mine iron ore in the same district.

Negotiations are reported to be well advanced for the establishment in Algeria of a cellulose industry based on alfa. The annual production of cellulose pulp should reach 60,000 tons, most of which will be exported.

Spanish purchases of cellulose for the industrial manufacture of artificial silk were intensified during the last months of 1945, the principal supplying countries being Norway and Sweden.

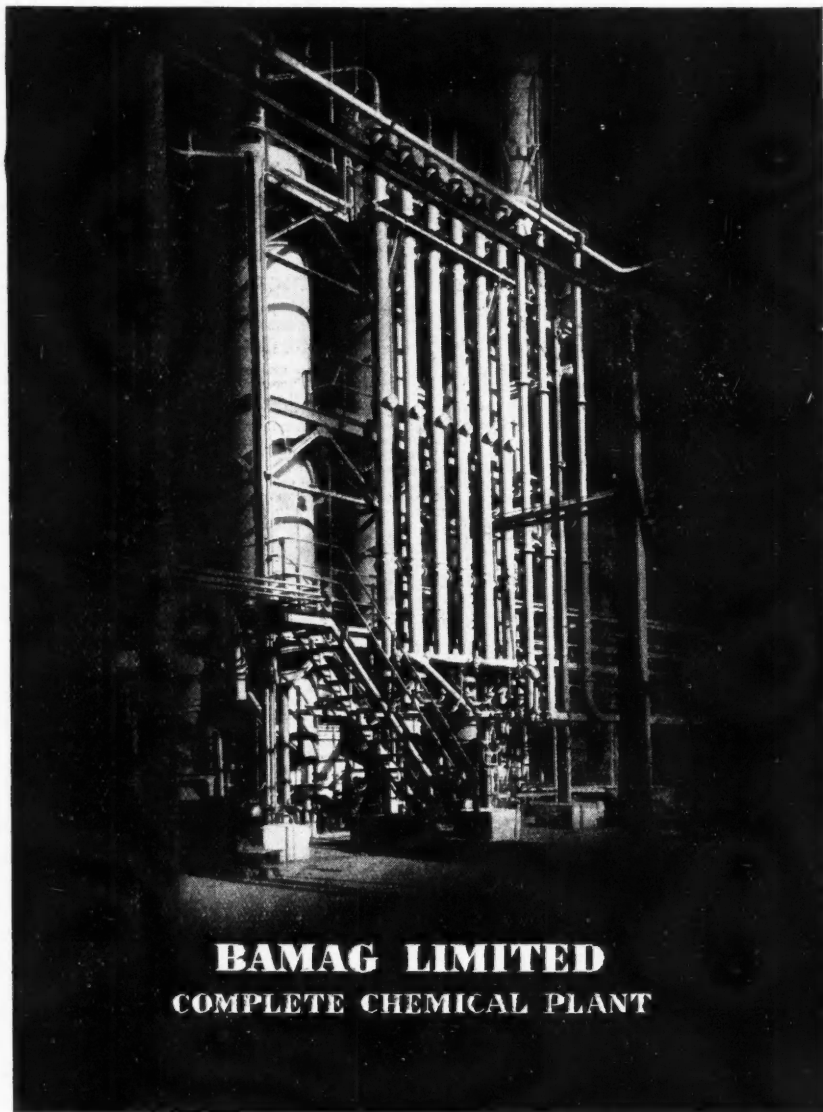
French production of wood pulp in January amounted to 11,894 tons, or slightly less than the 12,884 tons registered in December, 1945. Production of paper and cardboard in January, however, rose to 39,500 tons compared with 38,283 tons in December.

Eighty per cent. of the quota of aluminium distributed to manufacturing industries in France will in future be reserved for the production of articles of social utility. Maximum prices will be fixed for these articles by the Direction of Prices.

In Slovakia, the copper mines at Krompachy and the lead mines at Banská Stiavnica, which became flooded during the German occupation, are now being rehabilitated, but it will not be possible to resume mining operations during the first half of this year.

Heavy demand for cadmium has caused new controls on use in the United States, and the electroplating industry as well as other cadmium users must substitute other metals to prevent an early exhaustion of the cadmium supply. Current demand is now 9,000,000 lb. per annum against an estimated annual production of 8,000,000 lb.





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Forthcoming Events

April 9. Hull Chemical and Engineering Society. Regal Cinema, Ferensway, Hull, 7.30 p.m. Annual general meeting.

April 9. Chadwick Public Lecture. Royal Sanitary Institute, 90 Buckingham Palace Road, London, S.W.1. Dr. D. Winston Aldred: "The New Building Science" (Bossmo Gift Lecture).

April 10. British Plastics Federation. Savoy Hotel, London, W.C.2, 12.30 p.m. for 1 p.m. Twelfth annual luncheon.

April 10. Institute of Welding (Wolverhampton branch). Victoria Hotel, Wolverhampton, 7 p.m. Annual general meeting.

April 10. Royal Society of Arts. John Adam Street, Adelphi, 1.45 p.m. Mr. J. G. Pearce: "Cast Iron in Contemporary Building and Engineering."

April 10. North-Western Fuel Luncheon Club. Engineers' Club, Manchester, 12.30 p.m. Dr. E. V. Evans: "Research in the Fuel Industry."

April 10. British Association of Chemists (London Section). 1 Grosvenor Place, W.1, 7 p.m. Brains Trust (Mr. A. L. Bacharach, Mr. R. Barrington Brock, Mr. F. G. Moore, Mr. N. Swindin and Mr. G. Wilson, with Dr. F. W. Stoye as question-master).

April 11. Institute of Fuel. Institution of Mechanical Engineers, Storey's Gate, London, S.W.1, 2.30 p.m. Annual general meeting and presidential address.

April 12. Institute of Welding (Birmingham branch). James Watt Memorial Institute, Great Charles Street, Birmingham, 3, 7 p.m. Annual general meeting and dinner.

April 12. Institute of Welding (Liverpool branch). Liverpool Technical College, Byron Street, Liverpool, 7 p.m. Annual general meeting.

April 12. Institute of Fuel (S. Wales Section). Engineers' Institute, Cardiff, 5.30 p.m. Annual general meeting and dinner.

April 12. British Association of Chemists (Slough branch). The Floral Arms, High Street, Slough, 7.30 p.m. Mr. E. L. Holmes: "Ion-exchange Resins."

April 12. Institute of Welding (E. Scotland branch). Heriot Watt College, Chambers Street, Edinburgh, 7.30 p.m. Annual general meeting. F. Koenigsberger: "Technical efficiency in the welding shop."

April 12. Institute of Fuel (Scottish Section). Royal Technical College, Glasgow, 5.45 p.m. Mr. J. A. Kilby and Mr. W. G. Cameron: "Waste-Heat Boilers in the Iron and Steel Industry."

April 12. Institution of Chemical Engineers. Connaught Rooms, Great Queen Street, London, W.C.2. Annual corporate meeting. 11 a.m. business session (corporate

members only); 12 noon, Mr. Hugh Griffiths (president): "Vapour Phase Adsorption"; 1 p.m. luncheon.

April 12. Society of Chemical Industry (Food Group Microbiological Panel). London School of Hygiene and Tropical Medicine, Keppel Street, London, W.1, 2.15 p.m. Annual general meeting. Mr. T. W. Brandon and Dr. C. B. Taylor: "Recent Developments in the Retting of Flax and the Disposal of Waste Water"; Dr. L. A. Allen: "Recent Developments in the Microbiology of Retting."

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

W. A. MITCHELL & SMITH, LTD., Mitcham, chemical manufacturers. (M., 6/4/46.) March 15, £5000 (not ex.) mortgage to Lloyds Bank, Ltd.; charged on factory and land at Church Path, Church Road, Mitcham. *£494. October 31, 1945.

Company News

Viscose Development Co., Ltd., report net profit of £11,480 (£10,180) for 1945. Final ordinary dividend, 7 per cent., making 10 per cent. (same).

British Xylonite Co., Ltd., report net profit for 1945 totalling £707,050 (£618,876) with its subsidiaries, net profit for parent company being £40,773 (£33,359). Ordinary dividend, 10 per cent. (same).

Dominion Tar & Chemical Co., Ltd., report net profit of \$706,832 (\$671,511) for 1945. Common dividend, 25c. per share. The issued 5½ per cent. cumulative preference shares are to be redeemed on April 1 and replaced by preference shares yielding 4½ per cent.

African Explosives and Chemical Industries, Ltd., report net profit of £570,299 (£614,257) for the year ended September 30 last. Ordinary dividend, nil (20 per cent.). The company states it is not proposed to pay cash dividend on ordinary shares until second debenture stock has been redeemed. During the past year £200,000 of this stock was repaid, leaving £800,000 outstanding.



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Manganese Bronze and Brass Co., Ltd., report net profit of £81,407 (before payment of £24,000 for tax) as against £151,161 for previous year (before payment of £104,000 for tax). Final dividend $17\frac{1}{2}$ per cent., making 25 per cent. (same).

New Companies Registered

Howard-Taylor, Ltd. (407,203).—Private company. Capital, £10,000 in £1 shares. Manufacturing chemists, etc. Directors: M. W. Howard-Taylor, F. Howard-Taylor. Registered office: 89 Kingsway, W.C.2.

Pallas Chemicals, Ltd. (406,675).—Private company. Capital, £500 in £1 shares. Manufacturers of and dealers in chemicals and chemical products. Director: L. M. Smith. Registered office: 13 Mosley Street, Newcastle-on-Tyne.

Sanders Products (Liverpool), Ltd. (406,298).—Private company. Capital, £2000 in £1 shares. Manufacturers of chemicals, dyestuffs, etc. Directors: L. H. Sanders; Miss L. Ratcliffe. Registered office: 7 Brecon Street, Liverpool, 6.

Charles Leaver & Company, Ltd. (406,807).—Private company. Capital, £1000 in 975 6 per cent. preference shares of £1 each and 500 ordinary shares of 1s. Manufacturers of fine and other chemical and allied substances. Directors: H. L. Down; C. Leaver. Registered office: 39-41 New Broad Street, E.C.2.

Chemical and Allied Stocks and Shares

DESPITE more hopeful views of international affairs, stock markets showed an uncertain trend and the volume of business declined, there being a general disposition to await next Tuesday's Budget. Later, markets were aided by renewed strength of British Funds, which were in increased investment demand, particularly $2\frac{1}{2}$ per cent. Consols, which scored a sharp advance. Iron and steel shares continued to ease on uncertainty regarding nationalisation. Greek bonds responded to the election news, while elsewhere among foreign stocks, German Potash bonds showed sharp gains on the important part proposed for the potash industry in future German economy, the 7 per cent. bonds rising to 48, and the $6\frac{1}{2}$ per cent. to 45. Leading industrials moved within narrow limits, and in other directions share prices were mildly responsive to financial results which have again included a number of dividend increases and victory bonuses. Copper shares failed to hold an earlier rise in the mining markets, but tin shares responded to the increase in the U.K. export price for the metal. Courtaulds rose to 54s. 9d. on the

full results and the company's expansion programme.

Imperial Chemical at 40s. 3d. were little changed on balance, buyers coming in on any easing in the price. The view persists that the 8 per cent. dividend basis of recent years is likely to be maintained, and that there is a possibility of favourable benefits for shareholders arising from Dominion income tax relief. Lever and Unilever were firmer at 50s. 3d., but Turner & Newall at 80s. have been dull and Dunlop Rubber encountered a certain amount of profit-taking, the price easing to 52s. 9d. A feature was a sharp advance to 86s. 3d. in British Oxygen which were wanted on hopes of a higher dividend or victory bonus. British Drug Houses continued active around 58s., partly on anticipations of an improved dividend; it is now being suggested in the market that the expected share issue may be left until after the financial results have been issued. B. Laporte were 83s. 9d. British Aluminium eased to 37s. 9d., showing a yield of over 4 per cent. on the basis of last year's 8 per cent. dividend; having regard to the increasing uses of the metal, the assumption in the market is that as time proceeds, pre-war dividend levels are likely to be regained.

Borax Consolidated deferred were 44s. 3d., showing only a moderate yield on the unchanged $7\frac{1}{2}$ per cent. dividend; but the outlook is viewed as encouraging in view of demand from markets closed during the war, although for the time being restricted shipping space is a restrictive factor. Monsanto Chemicals $5\frac{1}{2}$ per cent. preference held steady at 23s., the results showing their dividend requirements to be covered over eight times. These shares are, however, redeemable at the company's option at 21s. 6d.; the ordinary shares are controlled by the Monsanto Chemical Company of St. Louis, U.S.A. British Xylonite results have been well received in view of the higher profits; the 5 per cent. preference, whose dividend is earned four times over, were 24s. 6d. The ordinary shares are not quoted; for many years their dividend has been 10 per cent., and last year over 20 per cent. was earned on this class of capital.

Iron and steels remained dull on nationalisation uncertainties. Hadfields 28s., Colvilles 25s., South Durham Steel 24s. 6d., and United Steel 23s. 3d. all receded moderately; while on the lower dividend, Thos. Firth & John Brown fell back to 50s. 3d. Vickers at 21s. 4 $\frac{1}{2}$ d. were easier on the big fall in trading profits of the English Steel Corporation. The latter reflects the transition from war- to peace-time working. Tax provision is, however, considerably reduced, and as a result, net profits are slightly higher and the dividend again $17\frac{1}{2}$ per cent., tax free. There has been selective buying of colliery shares on hopes of a number of dividend increases for the past year. Among oils the

tendency was firmer, Anglo-Iranian showing small fluctuations around £5.

British Chemical Prices

Market Reports

CONDITIONS in the London industrial chemical market have undergone very little change during the past week. In most sections a good volume of export inquiry has been sustained and there is a steady flow of new business for home account. The soda products generally are active, with chlorate of soda, caustic soda and hyposulphite of soda in strong demand. Bichromate of potash is in good request. Raw materials for the paint industry are active and there has been a steady call for contract deliveries. Both red and white lead are active, with prices unchanged at recent levels. In the coal-tar products market contract deliveries have been steadily maintained and a moderate weight of new business has been reported where supplies are available. Pitch continues to receive an active export inquiry while a moderate call for the toluols and xylois is reported.

MANCHESTER.—The undertone is strong in virtually all sections of the Manchester market for both light and heavy chemicals and trading conditions are satisfactory. The past week has witnessed a steady flow of delivery specifications against contracts from the textile bleaching, dyeing and finishing trades, and also from most of the other principal users. The alkalis generally, as well as the ammonia and magnesia compounds, potash chemicals, and the mineral acids, are finding a ready outlet among home consumers, and shippers have again been anxious to place business for export. For the leading fertilisers and tar products a steady absorption of supplies is reported.

GLASGOW.—Business in the Scottish heavy chemical market has been very active during the past week with increases in all materials for both home and export. Prices remain very firm. Supplies are still very short and it is not possible to meet the existing demand.

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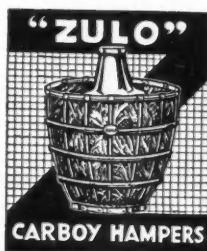
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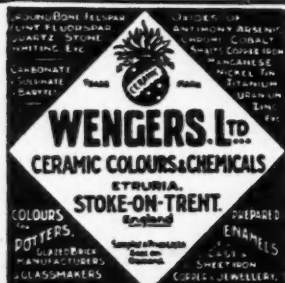
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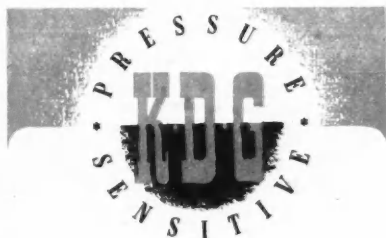
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